Am. B. 3040 (112, 3)

Königlich Bayerische Akademie
der Wissenschaften.
— München. —

Royal Bavarian Academy of Sciences;
at Munich, - Bavaria, - Germany. -

From LIEUT. COLONEL J. D. GRAHAM,

U. S. TOPOGRAPHICAL ENGINEERS.

Chicago, Illinois, United States of America.

Proceedings

MONACENSIS

35TH CONGRESS, 1st Session. } SENATE. { Ex. Doc. No. 42.

REGLA MONACENSIS

REPORT

OF

THE SECRETARY OF WAR,

COMMUNICATING

The report of Lieutenant Colonel J. D. Graham for the year 1857, *containing the information called for by the resolutions of the Senate of the 4th, 5th, and 26th of January.*

FEBRUARY 10, 1858.—Read and ordered to lie on the table. Motion to print referred to the Committee on Printing.

MARCH 31, 1858.—Report in favor of printing submitted, considered, and agreed to.

WAR DEPARTMENT,
Washington, February 10, 1858.

SIR: I have the honor herewith to transmit a communication of the colonel of the corps of Topographical Engineers, accompanied by the annual report of Lieutenant Colonel J. D. Graham for the year 1857, in relation to lake harbor improvements, called for by the resolutions of the Senate of the 4th, 5th, and 26th ultimo.

Very respectfully, your obedient servant,

JOHN B. FLOYD,
Secretary of War.

Hon. J. C. BRECKINRIDGE,
President of the Senate.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, February 9, 1858.

SIR: I have the honor of transmitting herewith a copy of the annual report of Lieutenant Colonel J. D. Graham, corps Topographical Engineers, for the year 1857, containing the information called for by resolutions of the Senate of the 4th, 5th, and 26th ultimo, in relation to the improvement of harbors on the northern and northwestern lakes, with copies of the maps therein referred to, except those of the harbors of New Buffalo, Michigan, and Chicago, Illinois, which will be transmitted as soon as received from Lieutenant Colonel Graham.

Respectfully, sir, your obedient servant,

J. J. ABERT,
Col. Corps Topographical Engineers.

Hon. JOHN B. FLOYD,
Secretary of War.

Report (No. 200) of Brevet Lieutenant Colonel James D. Graham, Major United States corps of Topographical Engineers, upon the lake harbor improvements under his direction for the year 1857.

OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

SIR: I have the honor to submit this my annual report upon the lake harbor works under my direction for the year 1857. These works are for the improvement of harbors on the north and northwestern lakes, as follows, viz:

I.—LAKE MICHIGAN.

1. Chicago harbor, Illinois.
2. Waukegan breakwater, Illinois.
3. Kenosha harbor, Wisconsin.
4. Racine harbor, Wisconsin.
5. Milwaukee harbor, Wisconsin.
6. Sheboygan harbor, Wisconsin.
7. Manitowoc harbor, Wisconsin.
8. Michigan City breakwater, Indiana.
9. New Buffalo harbor, Michigan.
10. Saint Joseph harbor, Michigan.
11. Black Lake harbor, Michigan.
12. Grand Haven harbor, at the mouth of Grand river, Michigan.

In addition to the above, I have made surveys of the following on Lake Michigan, with a view to projects for their improvement, if deemed desirable, viz:

13. Mouth of South Black river, Michigan.
14. Mouth of Kalamazoo river, Michigan.

II.—LAKE ST. CLAIR.

15. Mouth of Clinton river, Michigan.

III.—LAKE ERIE.

16. Monroe harbor, mouth of the river Raisin, Michigan.
17. Sandusky harbor, Ohio.
18. Huron harbor, Ohio.
19. Vermilion harbor, Ohio.
20. Black River harbor, Ohio.
21. Cleveland harbor, Ohio.
22. Grand River (Fairport) harbor, Ohio.
23. Ashtabula harbor, Ohio.
24. Conneaut harbor, Ohio.
25. Erie harbor, Pennsylvania.
26. Dunkirk harbor, New York.
27. Buffalo harbor, New York.

IV.—LAKE ONTARIO.

28. Oak Orchard harbor, New York.
29. Genesee harbor, (mouth of Genesee river,) New York.
30. Sodus Bay harbor, Wayne county, New York.

31. Sodus Bay harbor, Cayuga county, New York.
32. Oswego harbor, New York.
33. Ogdensburg harbor, New York.

V.—LAKE CHAMPLAIN.

34. Burlington breakwater, Vermont.

The works numbered from 16 to 24, inclusive, on Lake Erie, have been heretofore under the direction of Captain Stansbury, of the corps of Topographical Engineers. Those numbered from 25 to 27, inclusive, on Lake Erie, and from 28 to 33, inclusive, on Lake Ontario, and No. 34, on Lake Champlain, have heretofore been under the direction of Brevet Colonel Turnbull, major corps of Topographical Engineers.

They were turned over to my direction by the orders of the War Department of the 10th and 11th of December, 1856, those officers being required for other important duties—(See papers marked A 1, and A 2, hereto attached.)

I will proceed to report upon these works in the order in which they are above set down.

I will first, however, enumerate the maps and drawings which have been prepared in this office and forwarded in duplicate to the Topographical Bureau, and which are necessarily referred to, for illustration, in this report. They are:

MAPS OF LAKE HARBOR IMPROVEMENTS.

[Not printed with this report.]

Map G, No. 16.—Map of Milwaukee harbor, Wisconsin, from surveys made in 1854.

Map G, No. 17.—Map showing the limit of the excavation of the Fort Dearborn military reservation for the improvement of the navigation of the Chicago river, granted by the act of Congress of July 21, 1852, and showing also the lots in the said reservation granted to Jean Baptiste Beaubien by the act of Congress of August 1, 1854.

Sheet G, No. 18.—A perspective drawing, showing the old method of constructing cribs for harbor piers.

Sheet G, Nos. 19, 20, and 21.—Sheets of drawings showing Lieutenant Colonel Graham's methods of constructing cribs for said purposes, under various cases therein described.

Sheet G, No. 24.—Drawings illustrating the proposed manner of rebuilding the Chicago harbor piers above water in solid stone masonry.

Map G, No. 29.—Map of Waukegan harbor, Illinois, from survey in 1855, showing the proposed breakwater.

Sheet G, No. 31.—Drawings in isometrical perspective of a chevaux-de-frise barrier to protect Kenosha and Racine harbors from sand drifts.

Map G, No. 32.—Map of Racine harbor, Wisconsin, from surveys in 1855.

Map G, No. 36.—Map illustrating Lieutenant Colonel J. D. Gra-

ham's report on the improvement of the navigation at the mouth of Clinton river, State of Michigan, of December 31, 1855.

Sheet G, No. 37, in 3 sections or parts.—Graphic profile, showing the daily fluctuation in the elevation of the surface of Lake Michigan at the extremity of the north pier of Chicago harbor from September 1, 1854, to December 31, 1855; also showing the hour of observation, the direction and force of the winds, the nature of the weather, and the elevation of the lake surface.

Map G, No. 38.—Map of Chicago harbor and bar, from surveys made between the 29th of March and 9th of April, 1856.

Map G, No. 43.—Chicago harbor and the remnant of the bar, showing the effect of the dredging done between the 22d of April and the 15th of ~~D~~ember, 1856.

Sept.

Map G, No. 44.—Chicago harbor and bar, from survey made between the 11th and 14th of November, 1856, showing the effect of the violent gales of wind from the N. W. and N. N. W., on the 12th, 13th, 14th, and 23d of October, 1856, in diminishing the depth of water over the bar by the north channel.

Map G, No. 45.—Sheboygan harbor, Wisconsin, from survey made in August, 1856.

Map G, No. 46.—Manitowoc harbor, Wisconsin, from survey made in August, 1856.

Map G, No. 47.—St. Joseph harbor, Michigan, from survey in August, 1856.

Map G, No. 48.—Black Lake harbor, Michigan, from survey in September, 1856.

Map G, No. 49.—Harbor of Grand Haven, at the mouth of Grand river, Michigan, from survey made in October, 1856.

Map G, No. 50.—The mouth of South Black river, Michigan, from survey made in August, 1856.

Map G, No. 51.—The mouth of Kalamazoo river, Michigan, from survey made in September, 1856.

Map G, No. 52.—Chicago harbor and bar, Illinois, from survey made in April, 1857, showing the effect of the scour produced by the spring freshet, in deepening the harbor entrance near the east extremity of the United States north pier.

Map G, No. 53.—Kenosha harbor and bar, Wisconsin, from survey made in May, 1857.

Map G, No. 54.—New Buffalo, and the marshes at the mouth of Galian river, Michigan, showing the facilities for constructing a harbor of refuge there. Sept. 1857.

Map G, No. 55.—Showing the dilapidated condition of the piers of St. Joseph harbor, Michigan, on the 30th of September, 1857.

I—LAKE MICHIGAN HARBOR WORKS.

1. Chicago Harbor, Illinois.

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My annual report for 1856 (No. 161) gave a full account of the condition of this harbor up to the date of the 15th of November of that year. All the details will be found in printed Senate (Executive) Doc. No. 16, of the 34th ~~of~~ Congress, 3d session, pages 302 to

337. At the date of that report the harbor was still open, and navigation was going on.

Notwithstanding the boisterous weather of that season, navigators were cheered by the facilities for entering the harbor, which had been produced by means of the dredging done during that year under the direction of this office; and although some serious disasters occurred to shipping off the harbor, arising from violent gales, the number would have been far greater and more dreadful but for the channel at the harbor entrance secured by the dredging, a full account of which will be found in the above mentioned document, from page 303 to page 308, and by reference to maps G, Nos. 38, 43, and 44. Unfortunately, the same operation could not be repeated during the season of the present year for want of appropriations of the necessary funds.

As early as the 3d of December, 1856, there was much ice floating in the river; and on the 6th the river was frozen over at the foot of Rush street, so as to enable people to pass over, on foot, in safety. At this time navigation was so far obstructed as to prevent vessels from entering the river beyond its mouth, near the north pier-head. It remained so until December the 11th, when the river was again open, and navigation was resumed and continued until the 14th, when the schooner Pilot, the last vessel of the season, entered.—(See the remarks in the accompaning table, marked A 4.)

From the 15th of December, 1856, until the 18th of March, 1857, the shipping was laid up in the harbor and navigation suspended. This winter was not so cold as the preceding one. The lowest range of the thermometer during the winter of 1856–'7, was eighteen degrees below zero—18° of Fahrenheit—which occurred on the morning of the 23d of January, 1857. Early in February there was a general thaw. On the 7th of that month there came a rain which melted the snow, and produced a general freshet in the west. It did much damage in many parts of the country. On that day the ice started, and was floating down Chicago river for two days in large quantities. It began to accumulate in so large a mass in the river, within the city of Chicago, as to threaten a damming up of the waters and a consequent overflow in the city. This was probably prevented by the turning out of a large force of men, who cut away a free passage for the ice, so that it could find an outlet into Lake Michigan.

On the 8th of March the river was again frozen over from the foot of Rush street to the harbor entrance, and so remained until the middle of that month. On the 18th the schooner Liberty arrived in the harbor, which was then open for the season.—(See remarks in table A 4.)

The scour of the river current, produced by the freshet of this season, was so great as to cut out a channel through the bar off the harbor entrance twelve feet deep, or more.

In order to show the effect of this freshet on the character of the harbor, a new survey of it was made at the earliest practicable period. It was commenced on the 9th of April, and the soundings on the bar and the harbor entrance were completed on the 24th of that month.

The accompanying map, marked G, No. 52, shows the condition of the bar and harbor entrance, as projected from this survey. It shows

a narrow channel of 12½ feet deep over the bar near the north pier-head, which is very unusual after the winter deposit of sand.

We were not enabled to dredge this harbor the present season for want of the necessary funds to defray the expenses. No appropriation has been made for this harbor since the year 1852.

The registry of the heights of the lake surface, by daily observations on the permanent tide-gauge fixed on the north pier-head, (see maps G, Nos. 43. 44, and 52,) has been continued to the present time. The accompanying table, marked A 4, shows the result of these observations, beginning on the 17th of November, 1856, and continued to include the 30th of September, 1857. I continue to regret the want of a proper set of meteorological instruments, to be observed in connexion with this tide-gauge. Observations on the temperature of the external atmosphere are added after the 7th of December, 1856. The hours of these observations are not the best for accurate deductions respecting the climate, but, not being allowed a separate meteorological observer, I was not enabled to have these thermometrical records made, except at hours which were convenient to an assistant whose chief occupation was of a very different kind.

Such as they are, however, they will afford some interest in relation to the climate of Chicago.

I present, also, another table, marked A 5, containing a daily registry of the height and fluctuations of the surface of Chicago river, as observed upon a permanent tide-gauge, fixed at the south landing of the "Free Ferry," opposite to the termination of Rush street. (See maps G, Nos. 38, 43, and 44.) The zero, (0) or plane of reference of this tide-gauge, was fixed with the levelling instrument to correspond with that of the tide-gauge on the north pier-head.

This registry includes the period between the 1st of April, 1856, and the 30th of September, 1857.

I give below the monthly averages of the readings of the tide-gauge on the north pier-head, from the 1st of September, 1854, to the 30th of September, 1857, a period of three years and one month.

The daily observations from which these monthly averages are derived, from September 1, 1854, to December 31, 1855, will be found from page 85 to page 96 of the printed Senate Ex. Doc. No. 16, of the 34th Congress, 3d session. Those from January 1, 1856, to November 17, 1856, will be found from page 321 to page 328 of the same document.

Those from November 18, 1856, to September 30, 1857, are contained in the table A 4, accompanying this report.

These monthly averages are as follows.

Monthly averages.

Year.	Month.	Monthly mean height of lake surface, per tide-gauge, in feet and decimals.
1854	September	2.79
	October	2.22
	November	1.95
	December 1 to 18, and 26 to 31	1.87
1855	January 1 to 20	1.61
	February; tide-gauge frozen, and no observations	----------
	March 15 to 31	1.65
	April	1.73
	May	2.40
	June	2.63
	July	2.72
	August	2.83
	September	2.92
	October	2.79
	November	2.59
	December 1 to 25	2.69
1856	January; tide-gauge frozen from December 26 to January 31, and no observations	----------
	February; tide-gauge frozen from 1st to 28th, inclusive; observed on the 29th	2.40
	March, 27 days observed	2.29
	April	2.42
	May	2.83
	June	2.77
	July	2.84
	August	2.66
	September	2.56
	October	2.34
	November	2.25
	December, 20 days observed	2.25
1857	January, 13 days observed	2.00
	February, 5 days observed	2.13
	March; tide-gauge frozen, and no observations	----------
	April, 22 days observed	2.71
	May	3.07
	June	3.46
	July	3.80
	August	3.99
	September	3.84

The monthly averages of the readings of the tide-gauge kept at the ferry,* opposite to the foot of Rush street—having the same zero (0) or plane of reference as that for the tide-gauge at the north pier-head—

* NOTE.—After the record of December 5, 1856, this tide-gauge was removed from the ferry and placed on the south side, and near the west end of the ice-breaker of the middle pier of the new Rush street bridge. It was so adjusted that the zero (0) of the scale was in the same horizontal plane, or level, as before the removal. The first observation made on it in its new position was on the 1st of April, 1857. J. D. G.

from the 1st of April, 1856, to the 30th of September, 1857, show the height of the surface of Chicago river at that point as follows, viz:

Year.	Month.	Monthly mean height of the surface of Chicago river at the ferry* at the foot of Rush street, in feet and decimals.
1856	April	2.72
	May	3.10
	June	3.77
	July	3.22
	August	2.94
	September	2.55
	October	2.56
	November	2.38
	December; by observations from the 1st to 5th inclusive	3.09
1857	January; tide-gauge frozen, and no observations could be made	----------
	February; tide-gauge frozen, and no observations could be made	----------
	March; tide-gauge frozen, and no observations could be made	----------
	April	2.79
	May	3.22
	June	3.60
	July	3.97
	August	4.06
	September	4.07

The summer of 1857 was one of unusually mild temperature, and the evaporation from the surfaces of the great lakes was much less than in the average of summers. This may account for the increased elevation of the surface of Lake Michigan the past season.

In order that the horizontal plane of reference, or zero (0) of comparison, of our two tide-gauges may be easily hereafter restored, should they ever be lost, I will repeat here the elevations of the following permanent objects above the same zero or horizontal plane, which have been carefully obtained with a levelling instrument. They are as follows, viz:

1. The surface of the stone base on which rest the stone pilasters of the stone masonry basement at the northwest corner of the United States marine hospital situated at the foot of Michigan avenue, 12.83 feet.

2. The upper surface of the stone sills of the west basement windows of this hospital, 13.92 feet.

3. The top surface of the stone basement wall on which the iron railing rests at the northwest angle of the hospital enclosure, 14.83 feet.

* See note, page 7.

Without permanent reference objects like these, there is a great uncertainty attending any attempt to reduce different series of observations, made at intervals of several years apart, into one general table. To do so may risk a vitiation of the whole.

The penal bond of the Illinois Central Railroad Company, pursuant to the permission granted by the War Department to said company, under certain specified conditions and restrictions,* to make a second opening in the United States south pier of Chicago harbor, to communicate, from the harbor, with the company's second ship basin,† has been drawn, and would have been executed and forwarded to the Topographical Bureau before this time, but for the absence of the president of the company in Europe. This will now, however, be immediately attended to.

Application has recently been made by the "Chicago Dock and Canal Company" for the grant, from the War Department, of a like privilege to make an opening through the United States north pier, to communicate, from this harbor, with ship basins and canals which the said company propose to construct within certain grounds owned by it, immediately north of, and adjacent to, the said pier.

The accompanying papers, marked A 6, A 7, and A 8, including a copy of the act of the legislature of the State of Illinois, approved the 12th of February, 1857, incorporating the said company, will explain the whole subject.

Another application was at the same time made by the same company for permission to rebuild and keep in repair, free of expense to the United States, a portion of the said United States north pier, lying adjacent to the aforesaid lands of said company, on condition that the company be allowed to use the pier thus repaired as a dock front to its property for landing such goods, wares, merchandise, and chattels as may be desired to be landed. The papers relating to this application are hereto attached, marked A 9 and A 10.

[P. S. The decision of the War Department upon both these applications having been received at this office since the date of this report, it is thought proper to add it, in order to show the disposition which has been made of them.

The decision is accordingly hereto attached, marked A 12.

In pursuance of this decision, the requisite penal bonds binding the company to observe and comply with the conditions specified will be drawn and forwarded to the Topographical Bureau as soon as practicable.]

Repair of Chicago harbor piers.

The necessity of speedily repairing these piers, in order to save the harbor from destruction, was fully set forth in my annual reports, both for 1855 and 1856. The remarks then presented on this subject will be found in printed Senate (Ex.) Document No. 16, of the 34th Con-

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* See papers marked A 17, 18, and 19, at pp. 329 to 331 of Senate (Executive) Doc. No. 16, of the 34th Congress, 3d session.

† See map G, No. 43, now in the Topographical Bureau.

gress, 3d session, at pp. 29 to 32, and again at pp. 308 to 311. The continued decay of the pier timbers above the water level renders this measure still more imperative now than ever before. The small amount of funds which were in hand at the time of my last annual report has been expended in endeavoring to patch up the most decayed parts, where breaches had actually occurred, but it was quite inadequate to cure all the cases that have demanded attention. I have therefore sold all the remnants of movable property belonging to this harbor, under the rules of the War Department, in order to raise a small fund to be applied to this object. I feel confident, however, that it is quite inadequate to save the harbor from ruin, unless a speedy appropriation be made in aid of this very important work.

The timbers are now in so rotten a condition as to crumble in several places with their own weight; and there are several places where a vessel carried against them in a strong wind would make a breach, and thus allow the sand in high winds to be blown into the river and also to be driven in by the lake swash, and thus ruin the harbor. Such a catastrophe would prove a deadly blow to the commerce of this port, as well as a serious injury to many other lake ports which are in brisk trade with Chicago.*

I recommend the same mode of repair which I have heretofore done, and that is to tear away the rotten timber work to a depth of one foot below the water level of the lake, and then to rebuild, generally with stone masonry, to a height of five feet above the same low water level. (See the sheet G, No. 24, now in the Topographical Bureau.)

There are some parts, described in my report of last year, which may be rebuilt with good oak timber. I refer to that report for special information regarding the cost of the repairs of the several sections therein described.

I have been again compelled, by public advertisements, to call attention to the regulations forbidding the piling of lumber and other heavy articles upon the harbor piers. (See the paper hereto attached, marked A 11.)

Unless some penal law be passed by Congress on this subject, it will be very difficult to protect the piers built at the expense of the United States for the preservation of the lake harbors generally from constant and serious injury. An officer in charge of these harbor works has no means ef enforcing the regulations of the War Department made for their preservation, except through the civil courts upon an action for trespass, and the penalty, if any were awarded, would have to be assessed by a jury, often totally unacquainted with the actual cost of keeping these works in repair. A law defining the penalty in such cases would seem to be the surest means of putting a stop to this evil.

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* *November* 7, 1857.—A vessel was this morning carried, in a strong gale of wind, against the river face of the north pier, nearly opposite the line of the lake shore, and so rotten were the timbers that she made a clear breach through them, meeting in the collision with a very slight resistance. It will require immediate attention and the greater part of the funds in hand to repair this breach, even in a temporary manner.

Extension of the south harbor pier.

In relation to this proposed pier extension, I ask a reference to the accompanying map of Chicago harbor, marked G, No. 52, projected from surveys made in April last, on a scale of $\frac{1}{2400}$, or 200 feet to one inch; and also to maps G, Nos. 43 and 44, of the same harbor, upon the same scale, projected from surveys made, respectively, in September and November, 1856. They show that a bar is in progress of formation immediately off the Illinois Central Railroad Company's breakwater, and to the east of the extremity of the south harbor pier, which, if not checked, must soon extend into the mouth of the river, to the great injury of the harbor.

This subject was brought to your notice in my annual report of last year.

For the purpose of preventing this evil to the harbor, I would again recommend that the south pier be extended 480 feet lakeward, by crib work, to be constructed in the manner there given in full detail. This will require fifteen cribs, each 32 feet long, 20 feet wide, and 20 feet high from top to bottom, or 15 feet high from the bottom to the water level. Sheet G, No. 20, will show the proposed mode of construction.

The dredging of Chicago harbor.

The importance of this department of our work, and the success which attended it, at an expense very small in comparison with its benefits, has been fully dwelt upon in my previous reports, to which I would now refer for full information under this head.

By constant dredging during the season most favorable for it, I feel well assured that Chicago bar can be kept subdued, and the harbor kept open, so as always to insure the safe entrance and departure of vessels drawing full thirteen feet of water, and all at a very small annual expense.

A steam dredge, to be applied exclusively to this object, is, however, essential to insure its accomplishment.

For these several objects, and to meet the necessary contingent expenses, such as office rent and fuel, stationery, commutation for quarters and fuel of the superintending engineer, pay of assistants, &c., I beg leave to refer to my estimates of last year, which will be found in full detail at pages 331 to 337 of printed Senate (Ex.) Document No. 16, of the 34th Congress, 3d session. They are marked in that printed document A 20 and A 21.

The following is a recapitulation of the items, viz:

1.	For repair of the piers in stone masonry.....	$115,454 66
2.	For repair of second section with oak timber.....	232 89
3.	For repair of third section with oak timber.....	1,933 64
4.	For machinery, (such as pile-drivers, crane scows and cranes, hoisting tackle, &c.,) pay of assistants, office rent and fuel for same, stationery, commutation of quarters and fuel of the superintending engineer, survey of harbor, &c.....	7,579 00

5. For a steam dredge-boat for Chicago harbor.....	$17,500 00
6. For meteorological instruments.....	232 50
7. For dredging Chicago harbor and bar.....	2,000 00
8. For extending the south harbor pier 480 feet lakeward	29,518 05
Amount required for Chicago harbor.....	174,450 74

Although the deterioration in the condition of the harbor piers is greater now than last year, and will require more work and materials now than would then have been needed, yet the prices of labor and materials have diminished in about the same ratio, owing to the monetary depression of the present time, and hence the estimates for last year may very justly be assumed as sufficiently accurate for the present year for this and some other harbors.

I was in hopes of being able to give the statistics and value of the commerce of this and the other lake harbors under my direction for this year in the same manner as they were given in my reports for 1855 and 1856; but the small remnants of appropriations on hand had to be reserved for necessary repairs under pressing circumstances, and hence I had not the means to collect the statistics. Should further appropriations be made, this very desirable information can be obtained next year.

The population of the city of Chicago is estimated at this time to be from 110,000 to 120,000 souls. No actual census has recently been taken, however.

Determination of the longitude of Chicago.

The determination of the longitude of some cardinal point on Lake Michigan is a desideratum which had been long neglected. Not having been supplied with the proper instruments for such a determination, it has not been in my power to present, in my previous reports, any observations in reference to this subject.

The geographical charts of no country can be received as entirely reliable unless they are based on the accurate determination of the latitudes and longitudes of a certain number of important points within the area which they embrace.

For the means afforded for presenting the following astronomical observations, showing a co-operation between Lieutenant E. D. Ashe, of the British navy, and myself, for obtaining the difference of longitude between Quebec and Chicago, I am partly indebted to that gentleman. Lieutenant Ashe is the director of the British observatory lately established at Quebec. Sir William Logan, who is engaged upon a geological map of the Canadas and the adjacent frontiers, was desirous to have its geographical accuracy improved by the determination, from astronomical observations, of the latitudes and longitudes of some principal points within its area. Chicago was included as an important frontier position. Its determination was equally important for our own charts.

In April last Lieutenant Ashe arrived here from Quebec, and requested my co-operation with him in obtaining the difference of longi-

tude between the two places. He requested me to take charge of the instruments and observations at this end of the line, and he very kindly placed at my disposal a portable transit, which he had brought with him, of twenty-three inches (23 inches) focal length of telescope, and $1\frac{3}{4}$ inch (one and three-fourth inch) aperture, or diameter of object glass. This instrument was made by John Newman, of 122 Regent street, London. The object glass defines uncommonly well for its size, and is very satisfactory to the observer. The diaphragm of the telescope has one horizontal and five vertical spider lines or wires. The equatorial intervals of the wires were determined by seventy-three observed transits of stars of various north and south declinations, as shown in detail in the accompanying paper, marked A 13.

The values of the divisions on the scale of the level to the transit axis were determined by careful observations in the manner shown in the accompanying paper, marked A 14.

All the observations at this end of the line were reduced to the middle wire, and then again to the true meridian. The difference between this last result and the star's apparent right ascension, taken from the table given in the British Nautical Almanac for the year 1857, gave the chronometer error.

After the transit was mounted and adjusted in the meridian, and the necessary preliminary arrangements made with the telegraph companies for transmitting signals,* a continued series of bad nights for this operation ensued, which prevented the working of the wires throughout this long line.

On the night of the 15th of May the weather was clear at both stations, and very favorable to the observations, and to the transmission of the electric signals along the telegraphic wires. This was done by one entire current from either end of the line to the other, and without any intermediate repetition. The route by the wires, beginning at Chicago, was *via* Toledo, Cleveland, Buffalo, Toronto, and Montreal, to Quebec, and *vice versa* when the signals were sent from Quebec to Chicago. The distance between the two observing stations, measured along the wires, is twelve hundred and ten (1,210) miles, and yet the signals made at either end of this long line were recognized with perfect distinctness at the other end.

Lieutenant Ashe's reductions of his transit observations are to a mean of his wires.

The following are the observations made to determine the *local time* at the two stations, viz:

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*The use of the wires for this purpose had been secured by Lieutenant Ashe through an understanding with the telegraph companies before he arrived at Chicago.

Observations of meridian transits of stars made at Chicago, Illinois, by Lieut. Col. J. D. Graham, United States Topographical Engineers, for the time, May 15, 1857.

Station: The Roman Catholic Church on Wolcott street, between Huron and Superior streets.
Approx. Lat., 41° 54′N. *Approx. Long.*, 5*h*. 50*m*. 31*s*. west of Greenwich.
Instruments: Transit, by Newman, of 23 inches focal length, and 1¾ inch aperture; and mean solar chronometer No. 141, by Lukens, of Philadelphia.

Date.	Illumination.	Names of stars observed.	No. of wires observed.	Reduction to the middle wire.	Corrections in *time* for errors of instrument.	Time by chronometer of transit over the true meridian.	Computed mean solar time of transit.	Chronometer No. 141 slow of mean solar time.
1857.				*h. m. s.*	*s.*	*h. m. s.*	*h. m. s.*	*m. s.*
May 15	East...	*a* (Alpha) Ursæ Majoris	5	7 17 22.81	+ 1.03	7 17 23.84	7 20 7.16	2 43.32
		δ (Delta) Leonis	5	7 28 59.39	— 0.69	7 28 58.70	7 31 41.58	2 42.88
		δ (Delta) Hyd. et Crateris	5	7 34 40.18	— 1.57	7 34 38.61	7 37 21.93	2 43.32
		γ (Gamma) Cephei (sub-polo)	5	7 55 52.84	— 4.13	7 55 48.71	7 58 32.05	2 43.34
		β (Beta) Leonis	5	8 4 9.38	— 1.02	8 4 8.36	8 6 51.73	2 43.37
		Mean 1st, illumination east						2 43.25
	West ..	*γ* (Gamma) Ursæ Majoris	1	8 8 39.70	+ 1.17	8 8 40.87	8 11 23.85	2 42.98
		ε (Epsilon) Corvi	5	8 25 8.29	— 2.53	8 25 5.76	8 27 48.83	2 43.07
		η (Eta) Virginis	5	8 34 54.88	— 1.77	8 34 53.11	8 37 36.31	2 43.20
		*γ*¹ (Gamma 1st) Virginis	5	8 56 41.34	— 1.72	8 56 39.62	8 59 22.35	2 42.73
		α (Alpha) Ursæ Minoris (Polaris)	2	9 29 52.60	—90.00	9 28 22.60	9 31 1.63	
		θ (Theta) Virginis	5	9 24 44.70	— 1.78	9 24 42.92	9 27 25.83	2 42.91
		Mean, illumination west						2 42.98

East	α (Alpha) Ursæ Minoris (Polaris)	2	9 29 23.36	—64.80	9 28 18.56	9 31 1.63	
	α (Alpha) Virginis	5	9 39 49.24	— 2.01	9 39 47.23	9 42 30.25	2 43.02
	ξ (Zeta) Virginis	5	9 49 31.34	— 0.98	9 49 30.36	9 52 13.51	2 43.15
	η (Eta) Ursæ Majoris	5	10 3 58.06	+ 0.53	10 3 58.59	10 6 41.74	2 43.15

	m.	*s.*
Mean: Illumination east, (2d)	2	43.11
Mean: Illumination east, (1st,) as above	2	43.25
Grand mean: Illumination east	2	43.18
Mean: Illumination west	2	42.98
Result: Chronometer No. 141, by Lukens, slow of Chicago mean solar time at 8*h*. 47*m*., May 15, 1857	2	43.08

Observations of May 15, 1857, *continued with the same instruments.*

2d.—Set this night. After making the telegraphic signals, the chronometer having in the mean time been carried by hand from the observatory to the telegraphic office, the signals noted by it, and then brought back by hand to the observatory.

Date.	Illumination.	Names of stars observed.	No. of wires observed.	Reduction to the middle wire.	Correction in *time* for errors of instrument.	Time by chronometer of transit over true meridian.	Computed mean solar time of transit.	Chronometer No. 141 slow of mean solar time.
1857.				*h. m. s.*	*s.*	*h. m. s.*	*h. m s.*	*m. s.*
May 15.	East	α (Alpha) Herculis	5	13 29 37 83	— 0.47	13 29 37.36	13 32 20.56	2 43.20
		θ (Theta) Ophiuchi	5	13 34 44.34	— 1.23	13 34 43.11	13 37 26.17	2 43.06
		β (Beta) Draconis	5	13 48 38.40	+ 0.79	13 48 39.19	13 51 22.27	2 43.08
		μ (Mu) Herculis	5	14 02 16.38	— 0.09	14 02 16.29	14 04 59.25	2 42.96
		γ (Gamma) Draconis	5	14 14 39.35	+ 0.20	14 14 39.55	14 17 22.80	2 43.25
		μ^1 (Mu 1st) Sagittarii	5	14 26 33.57	— 0.45	14 26 33.12	14 29 16.36	2 43.24
		δ (Delta) Ursæ Minoris	2	14 39 55.5	— 0.47	14 39 55.03	14 42 38.38	----------
		51 (Hevelius) Cephei (sub-polo)	5	14 53 09.86	+ 0.29	14 53 10.15	44 55 53.56	----------
		β (Beta) Lyrae	5	15 06 01.85	+ 0.11	15 06 01.96	15 08 44.64	2 42.68
		Mean illumination east						2 43.06
	West	ζ (Zeta) Aquilae	5	15 20 01.02	+ 0.46	15 20 01.48	15 22 44.51	2 43.03
		ω (Omega) Aquilae	5	15 32 15.00	+ 0.52	15 32 15.52	15 34 58.54	2 43.02
		δ (Delta) Aquilae	5	15 39 24.72	+ 0.59	15 39 25.31	15 42 08.40	2 43.09

Mean illumination west	2 43.05
Mean illumination east	2 43.06
Grand mean, after telegraphic signals, mean period of observations, 14*h*. 56*m*.	2 43.055
Grand mean, before telegraphic signals, as above, mean period of observation, 8*h*. 47*m*.	2 43.08

Final result.—Chronometer No. 141 was slow of Chicago mean solar time when the telegraphic signals were made 2 43.07

Observations of the meridian transits of stars at Quebec, by Lieut. E. D. Ashe, R. N., director of the Quebec Observatory, for clock error.

Station: The Quebec Observatory.
Aprox. Lat., 46° 48′ 20″ N. *Aprox. Long.*, 4*h*. 44*m*. 48.49*s*. W.
Instruments: Transit permanently mounted on stone pillars; and a sidereal clock.
Errors of transit instrument: Inclination, =—0.7*s*.
Collimation, = 0.0*s*.
Deviation, =—0.6*s*.

Date.	Illuminated end.	Names of stars.	Observed transit over mean wire.	Clock slow.
1857.			*h*. *m*. *s*.	*s*.
May 15	East	α (Alpha) Ursæ Minoris, (S. P)	13 05 54.00	
		ζ (Zeta) Virginis	13 27 11.72	15.82
		η (Eta) Ursæ Majoris	13 41 42.32	15.97
		η (Eta) Bootis	13 47 40.02	15.77
		τ (Tau.) Virginis	13 54 09.46	15.86
		α (Alpha) Bootis	14 08 55.92	15.71
		ρ (Rho.) Bootis	14 25 27.54	16.02
		ε (Epsilon) Bootis	14 38 31.96	15.97
		α^2 (Alpha 2d) Libræ	14 42 45.66	15.88
		β (Beta) Ursæ Minoris	14 51 02.10	15.64
	West	μ (Mu) Herculis	17 40 39.22	15.62
		γ (Gamma) Draconis	17 53 04.50	16.01
		μ^1 (Mu 1st) Sagittarii	18 05 00.14	15.72
		δ (Delta) Ursæ Minoris	18 18 26.40	
		51 (Hevelius) Cephei, (sub-polo)	18 31 37.80	
		ζ (Zeta) Aquilæ	18 58 37.10	15.74
		ω (Omega) Aquilæ	19 08 03.98	15.92
		δ (Delta) Aquilæ	19 10 53.18	15.70
Clock error: slow of Quebec sidereal time by a mean of the whole				15.83

It will be observed that a mean solar chronometer was used at Chicago, and a sidereal clock at Quebec.

After my last observation in my first complete set for the time at Chicago, which was on η (Eta) Ursæ Majoris at 10*h*. 06*m*. 41.7*s*., I carried my chronometer in hand from my observing station to the telegraphic office, a distance of one mile, by the streets.

This was unavoidable, because I had no means of bringing the wires to the station. Then, after completing the interchange of signals with Lieutenant Ashe, at Quebec, I brought my chronometer back, in hand to the observing station, and made a second complete set of observations for the time; the last observation of this set being on δ (Delta) Aquilæ, at 3*h*. 42*m*. 08.4*s*. past midnight. Fortunately, the night remained perfectly clear throughout, thus favoring a strong desire I had to ascertain from actual observation what effect this transportation of the chronometer, by hand, from the observing station to the telegraphic office and back again, would have upon its rate. It will be seen, by the record of the observations, that the effect on the rate was quite inappreciable, being only, as shown by the computations, .025 of a second; that is to say, $\frac{25}{1000}$, or $\frac{1}{40}$th of a second of time.

It will also be seen that Lieutenant Ashe's observations for the time, at Quebec, embraced a complete series both before and after the period occupied by the interchange of signals.

It would seem, from a close inspection of the observations, that the determination of the time at each end of this long line was as satisfactory as it could have been under any circumstances; so much so that I conceive the chief source of error, whatever it may be, in our joint result, to arise from any slight want of a perfect coincidence in time between the beat of the chronometer or clock and the click produced by pressing the telegraph key.

The whole number of signals successfully interchanged was twenty-eight, (28.) In the first place, seven signals were given at Chicago, at a common interval of one minute, mean time, and were noted at both stations by our respective chronometers or clocks; then seven were given at Quebec at a common interval of one minute of sidereal time, and were noted in the same manner. This operation was then repeated both ways at a common interval of half a minute.

In this way four coincident beats of the mean solar chronometer at one station and the sidereal clock at the other were obtained, which gave a more exact comparison of the local time for the two stations than could have been obtained from estimating by the ear the fractions of a second of time between the beat of the chronometer, or clock, and the click of the telegraph key.

It is for this reason that, out of the twenty-eight signals interchanged and recorded, only the four which correspond to the coincident beats of the timepieces at the two stations are used for obtaining the difference of longitude.

The following statement will show the whole operation and the result, viz:

Determination of the difference of longitude between Quebec and Chicago by telegraphic comparisons of time, May 15, 1857.

1st. Chicago signals recorded at both stations. Electric fluid transmitted from west to east.

Times of signals given at Chicago by mean solar chronometer. Lukens, No. 141, which was 2m. 43.07s. slow of Chicago mean solar time.	Chicago signals noted at Quebec by sidereal clock, which was 15.83s. slow of Quebec sidereal time.	Correct Chicago mean solar time of signals made at Chicago.	Chicago true sidereal time of Chicago signals.	Quebec true sidereal time of Chicago signals.	Difference of longitude—Chicago west of Quebec.
h. *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*
11 33 00	16 16 39	11 35 43.07	15 11 13.19	16 16 54.83	1 05 41.64
12 04 00	16 47 44	12 06 43.07	15 42 18.28	16 47 59.83	1 05 41.55

	h. *m.* *s.*
1st mean. Electric fluid transmitted from west to east	1 05 41.595

2d. Quebec signals recorded at both stations. Electric fluid transmitted from east to west.

Times of signals given at Quebec by sidereal clock, which was 15.83s. slow of Quebec sidereal time.	Quebec signals noted at Chicago by chronometer, Lukens, No. 141, which was 2m. 43 07s. slow of Chicago mean solar time.	Correct Chicago mean solar time of Quebec signals.	Chicago true sidereal time of Quebec signals.	Quebec true sidereal time of Quebec signals.	Difference of longitude—Chicago west of Quebec.
h. *m.* *s*	*h.* *m.* *s.*	*h.* *m.* *s.*	*h.* *m.* *s.*	*h* *m.* *s.*	*h.* *m.* *s.*
16 24 00	11 40 20	11 43 03 07	15 18 34 40	16 24 15.83	1 05 41.43
16 54 30	12 10 45	12 13 28. 07	15 49 04.39	16 54 45.83	1 05 41.44

		h. *m.* *s.*
2d mean.	Electric fluid transmitted from east to west	1 05 41. 435
1st mean.	Electric fluid transmitted from west to east, as above	1 05 41. 595
Result.	Chicago west, in longitude, of Quebec	1 05 41. 515

	h. *m.* *s.*
Difference between the results from the electric fluid being transmitted from west to east, or from east to west	0 00 00.16
Half difference	0 00 00.08

From which it appears that the electric fluid was transmitted along the wires between Chicago and Quebec, a distance of twelve hundred and ten miles, in eight-one hundredths ($\frac{8}{100}$) of a second of time. At this rate it would be only one and two-thirds ($1\frac{2}{3}$) second of time in being transmitted around the circumference of the earth.

I will now proceed to a deduction of the longitude of Chicago, west of the meridian of Greenwich, by combining the above result with a determination of the longitude of Quebec, made by myself in the year 1842, while serving as a commissioner and astronomer on the part of the United States for ascertaining our northeastern boundary under the treaty of Washington, of that year.

That determination (together with a number of others in various parts of the United States, Canada, New Brunswick, the republic of Texas,* &c.,) will be found, as they were published under my authority, at pages 366 to 369 of the American Almanac for the year 1848.

	h. *m.* *s.*
The longitude of the centre of the citadel of Quebec is there given, (see pp. 368 and 369 of that almanac,) west of Greenwich	4 44 49.65

*Before its annexation to the United States.

	h. *m.* *s.*
But the present Quebec Observatory is situated 180 feet east, in longitude, of the *centre* of the citadel. The difference of position is equal to 2.55 seconds of arc in that latitude. Its equivalent in *time* must therefore be deducted to bring the longitude of the Quebec Observatory conformable to my determination of the longitude in the year 1842, namely.....	—0.17
Longitude of the present Quebec Observatory, according to my determination of 1842.....	4 44 49.48
To which add the difference in longitude between the Quebec Observatory and the Roman Catholic church on Wolcott street, Chicago, as above determined.....	1 05 41.51

Result.

Longitude of the Roman Catholic church on Wolcott street, between Huron and Superior streets, Chicago...	5 50 30.99

	h. *m.* *s.* *s.*
By a careful triangulation we find the centre of the dome of the city hall of Chicago to be in longitude 1,236.16 feet west of the meridian of our observing station near the Roman Catholic church. This we put down as equal to 16.34 seconds of arc, or, in time.....	1.09
To which add the longitude of the observing station.....	5 50 30.99

	h. *m.* *s.*
Longitude of the city hall of Chicago, west of Greenwich,	5 50 32.08
	° ′ ″
Or, in arc.....	87 38 01.2

That is to say, in time, five hours fifty minutes thirty-two and eight-hundredths seconds;

And in arc, eighty-seven degrees thirty-eight minutes one and two-tenths seconds.

The transit was mounted on an oak pillar, sixteen inches square, inserted four feet in the ground and the earth rammed firmly around it. A flooring was then laid on sleepers, which rested at their outward ends on two parallel cross timbers, one foot square, so that any jar produced by walking on the floor had to be communicated to these outward cross timbers, and then vibrated back through the ground before its effect could reach the instrument stand. There was no contact between the floor and the oak pillar, or instrument stand. They were separated by a space of half an inch cut out of the flooring all round. These arrangements gave a very steady support for the transit.

It is very important in observations of this kind with portable instruments, that the level of the transit axis should be frequently

tested by actual observations of the level. Also that the azimuthal direction of the axis of the telescope should be verified as often as practicable in the course of a night's observations, by bringing into the series such circumpolar stars, or pairs of stars, either north or south, differing not much in *right ascension*, but a good deal (say forty degrees, or more) in *polar distance*, as are suitable for computing the azimuthal error, at various periods of the night.

The accompanying table, marked A 15, contains the observations and the results for the corrections of the level errors. They are given in the right hand column in equatorial time, and were reduced according to the stars' declinations.

The table marked A 16 contains the stars that were used for computing the azimuthal deviation at the several periods of the night indicated.

The error of collimation of the middle wire of the transit telescope was during the night's observations as follows, viz:

	s.
1. *With Illumination East:* For stars observed above the pole.....	— 0.2 of equatorial time.
For stars observed sub-polo.....	+ 0.2 of equatorial time.

	s.
2. *With Illumination West:* For stars observed above the pole.....	+ 0.2 of equatorial time.
For stars observed sub-polo.....	— 0.2 of equatorial time.

The magnetic declination at Chicago.

The declination, or horizontal variation from the true meridian, of the magnetic needle, was observed at Chicago on the 23d of July, 1857, with a circumferenter, having a transit telescope, and a needle four and a half ($4\frac{1}{2}$) inches long, as follows:

July 23, 1857.—*Mean time of observation*, 4 *o'clock p. m.*—Placed the instrument so that the axis of the telescope coincided with the true meridian, which had been determined with astronomical transit, near our temporary observatory.

North end of the needle reads.....	354°	10′	00″
South end of the needle reads.....	354	17	30
Mean.....	354	13	45
True meridian reads.....	360	00	00
1. Variation of the needle.....	5°	46′	15″ E. of N.

Revolved the circumferenter 180° in azimuth—

North end of the needle reads.....	174°	10′	00″
South end of the needle reads.....	174	18	00
Mean.....	174	14	00
True meridian reads.....	180	00	00
2. Variation of the needle.....	5°	46′	00″ E. of N.
1. Variation as above, by first experiment....	5	46	15 do
Magnetic declination at this station.....	5°	46′	07½″ do

That is to say, the magnetic declination at Chicago, on the 23d of July, 1857, at 4 o'clock in the afternoon, was five degress forty-six minutes and say one-tenth of a minute to the east of north.

A 1.

War Department order repealing the orders of ex-Secretary Conard, of September 16, 1852, *dividing certain works between the two corps of engineers.*

WAR DEPARTMENT,
December 10, 1856.

The order of this department of the 16th of September, 1852, dividing the works appropriated for by the act of August 30, 1852, between the two corps of engineers is hereby repealed.

JEFFERSON DAVIS,
Secretary of War.

A 2.

Special Orders, No. 160.]

WAR DEPARTMENT,
Adjutant General's Office, Washington, December 11, 1856.

The following changes of station and assignment to duty of officers of the corps of Topographical Engineers are directed by the War Department:

I. Brevet Lieutenant Colonel J. D. Graham, in addition to his present duties, will relieve Brevet Colonel W. Turnbull and Captain H. Stansbury of the harbor works on the northern and northwestern lakes, and take charge of the same.

* * * * * * *

By order of the Secretary of War.

S. COOPER,
Adjutant General.

A 3.

No. 164.] OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, December 22, 1856.

SIR: I have the honor to acknowledge the receipt of the order of the War Department of the 10th instant, repealing the order of Secretary Charles M. Conrad of the 16th September, 1852, dividing the works appropriated for by the act of Congress of August 30, 1852, between the two corps of engineers.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Major Topographical Engineers,
Brevet Lieutenant Colonel.

Colonel J. J. ABERT,
Chief Topographical Engineers, Washington.

A 4.

A register of the relative heights and fluctuations of the surface of Lake Michigan, from observations made under the direction of Lieutenant Colonel J. D. Graham, on a permanent tide-gauge fixed at the east extremity of the United States north pier of Chicago harbor, between November 17, 1856, *and September* 30. 1857.

Date.	Time of observation of the tide-gauge, and the winds and weather.	Surface of lake per tide-gauge, in feet and decimals.	Wind.		Temperature of the external air, (Fahrenheit.)			Remarks.
			Course.	Strength.	From 7 to 8 h. a. m.	12 h. noon.	From 2 to 3 h. p. m.	
1856.					°	°	°	
Nov. 17	10 a. m.	2.05	NW.	Light				Cloudy.
18	10 a. m.	2.18	NW.	Light				Clear.
19	10 a. m.	2.40	SE	Light				Clear.
20	10 a. m.	2.45	E.	Fresh				Clear.
21	10 a. m.	2.50	E.	Strong				Clear.
22	10 a. m.	2.20	SW.	Light				Cloudy.
23	10 a m.	2.10	SE.	Fresh				Clear.
24	10 a. m.	2.50	W.	Light				Clear.
25	10 a. m.	2.80	E.	Fresh				Rainy.
26	10 a. m.	2.40	W.	Fresh				Snow.
27	10 a. m.	2.20	SW.	Light				Cloudy.
28	10 a. m.	2.40	S.	Fresh				Clear.
29	10 a. m.	2.60	W.	Fresh				Clear.
30	10 a. m.	2.00	SW.	Light				Clear.
Dec. 1	10 a. m.	2.15	SW.	Light				Cloudy.
2	10 a. m.	3.90	NE.	Strong				Snow and rain.
3	10 a. m.	3.90	NE.	Fresh				Considerable ice in the river.
4	10 a. m.	2.48	W.	Fresh				Clear; much ice in the river.
5	10 a. m.	Tide-gauge frozen tight.	N.NW.	Light				Clear.

6	10 a. m.	Frozen	NW					River frozen so as to enable foot passengers to cross on the ice at the ferry; one vessel only arrived, and was unable to proceed further than the end of the north pier for the present.
7	10 a. m.	Frozen	W	Light	15		12	Fair; three vessels had arrived as far as the north pier, and were unable to proceed up the river on account of the ice.
8	10 a. m.	Frozen	SW	Light	12		13	Clear.
9	10 a. m.	1. 52*	SE	Light	28		30	Cloudy.
10	10 a. m.	1. 67*	ESE	Gentle	35		38	Rain.
11	10 a. m.	1. 60*	W	Light	32		30	Snow; river open, and navigation resumed; the propeller Sun arrived from Buffalo; also several sail vessels arrived from other ports.
12	10 a. m.	1. 44*	W	Light	32		25	Clear; several vessels arrived this day from various ports.
13	10 a. m.	2 10*	E.	Fresh	35		36	Snow.
14	10 a. m.	2. 94*	W	A gale	30		0	Snow; river closed; the schooner Pilot arrived; the last vessel of the season.
15	10 a. m.	1. 94*	W	Fresh	— 4†		— 2†	Clear.
16	10 a. m.	2. 04	W	Light	8		6	Snow.
17	10 a. m.	2. 19*	W	Light	18		22	Cloudy.
18	10 a. m.	2. 10*	SE	Fresh	20		26	Cloudy.
19	10 a. m.	2. 54*	ESE	Strong	30		42	Rain.
20	10 a. m.	Not observed	WSW	Strong	8		4	Fair.
21	10 a. m.	do	W	Fresh	6		22	Snow.
22	10 a. m.	do	NW	Fresh	— 4		0	Fair.

NOTE.—Average height, per tide-gauge, for 14 days in November, 1856, 2. 34 feet.

* These records of the height of the lake surface marked with an asterisk were kindly furnished by Mr. W. H. Clark, civil engineer to the Sewerage Commission, who established a water gauge at the Chicago water-works. These records are given here as they were reduced by the leveling instrument to our zero of comparison.

J. D. G.

† This sign — (minus) whenever it occurs indicates that the temperature is so many degrees below 0 (zero) of Fahrenheit's scale.

TABLE A 4—Continued.

Date.	Time of observation of the tide-gauge, & the wind and weather.	Surface of lake per tide-gauge in feet and decimals.	Wind.		Temperature of the external air, (Fahrenheit.)			Remarks.
			Course.	Strength.	6 h. a. m.	12 h. noon	10 h. p. m.	
1856.					°	°	°	
Dec. 23	10 a. m.	Not observed	NW	Fresh	2	10	15	Fair.
24	10 a. m.	2.53*	E.	Light	18	30	20	Cloudy.
25	10 a. m.	1.95*	WSW	Gentle	18	36	28	Clear.
26	10 a. m.	1.95*	E.	Light	30	35	32	Cloudy.
27	10 a. m.	Not observed	SE.	Fresh	28	31	30	Rainy.
28	10 a. m.	2.11*	W	Light	30	32	20	Fair.
29	10 a. m.	Not observed	W	Light	20	24	14	Fair.
30	10 a. m.	2.03*	W	Light	10	16	12	Cloudy.
31	10 a. m.	Not observed	SW	Light	14	20	16	Cloudy.
1857.								
Jan. 1	10 a. m.	2.45*	W	Light	18	24	20	Fair.
2	10 a. m.	1.95*	WNW	Fresh	26	30	22	Fair.
3	10 a. m.	Not observed	ENE.	Fresh	7	10	5	Fair.
4	10 a. m.	do	SW	Light	8	12	10	Cloudy.
5	10 a. m.	do	W	Light	14	20	15	Cloudy.
6	10 a. m.	do	W	Light	14	22	15	Fair.
7	10 a. m.	do	NW	Light	0	10	2	Fair.
8	10 a. m.	do	W	Light	2	15	13	Fair.
9	10 a. m.	do	SW	Light	18	22	20	Snow.
10	10 a. m.	2.78*	WNW	Light	20	24	22	Snow.
11	10 a. m.	2 37*	W	Light	20	22	16	Snow.
12	10 a. m.	1.61*	SW	Light	12	16	15	Fair.
13	10 a. m.	1 95*	SW	Light	14	20	18	Snow.
14	10 a. m.	2.45*	SW	Light	16	22	8	Snow.
15	10 a. m.	1.95*	W	Light	4	16	6	Fair.
16	10 a. m.	1.78*	NE	Fresh	10	24	18	Cloudy.

	17	10 a. m.	Not observed	W	Fresh	6	14	— 5	Cloudy.
	18	10 a. m.	2. 11*	SW	Light	— 6	20	— 4	Fair.
	19	10 a. m.	Not observed	W	Light	—11	18	12	Fair.
	20	10 a. m.	1. 78*	SW	Fresh	8	20	16	Fair.
	21	10 a. m.	Not observed	SW	Fresh	— 4	— 2	—12	Fair.
	22	10 a. m.	do	W	Fresh	—15	— 9	—12	Fair.
	23	10 a. m.	do	W	Fresh	—18	— 2	—16	Fair.
	24	10 a. m.	1. 45*	NW	Fresh	—14	— 0	—10	Fair.
	25	10 a. m.	1. 45*	W	Light	—10	18	8	Fair.
	26	10 a. m.	Not observed	SW	Fresh	8	32	20	Cloudy.
	27	10 a. m.	do	SW	Light	18	32	22	Fair.
	28	10 a m.	do	S	Light	24	30	26	Fair.
	29	10 a. m	do	SE	Light	20	30	26	Cloudy.
	30	10 a. m.	do	S	Light	24	38	20	Fair.
	31	10 a. m.	do	NW	Strong	14	8	3	Cloudy.
Feb.	1	10 a. m.	do	NW	Light	2	15	8	Cloudy.
	2	10 a. m.	1. 95*	SW	Light	3	26	18	Fair.
	3	10 a. m.	Not observed	S	Light	25	48	38	Cloudy.
	4	10 a. m.	do	SE	Fresh	36	34	26	Rain.
	5	10 a. m.	2. 11*	SW	Fresh	24	36	32	Rain.
	6	10 a. m.	2. 45*	NW	Strong	32	52	56	Rain.
	7	10 a. m.	Not observed	SE	Strong	45	50	26	Rain. The ice started from above the ferry. Current in the river very rapid and the water high.
	8	10 a. m.	2. 45*	W	Fresh	10	20	10	Fair. Much ice coming down the river to-day. The tug McQueen got up steam and went up the river as far as Clarke street bridge from the basin.
	9	10 a. m.	1. 70	SW	Strong	15	36	30	Fair.
	10	10 a. m.	Not observed	W	Fresh	18	24	15	Fair.
	11	10 a. m.	do	SE	Light	15	21	25	Fair.
	12	10 a. m.	Tide-gauge frozen†	SE	Fresh	20	48	38	Cloudy.
	13	10 a m.	do	S	Fresh	22	40	33	Fair.
	14	10 a. m.	do	S	Strong	41	54	48	Rain.

†Tide-gauge frozen tight at north pier head, and no further records were made at the water works.

NOTE.—Average height, per tide-gauge, for 20 days in Dec., 1856, 2. 25 feet. Average height, per tide-gauge, for 13 days in Jan., 1857, 2.00 feet.

A 4—Continued.

Date.	Time of observation of the tide-gauge, & the winds and weather.	Surface of lake, per tide-gauge, in feet and decimals.	Wind.		Temperature of the external air, (Fahrenheit.)			Remarks.
			Course.	Strength.	6 h. a. m.	12 h. noon.	10 h. p. m.	
1857.					°	°	°	
Feb. 15	10 a. m.	Tide-gauge frozen*	SE	Fresh	34	46	38	Rain.
16	10 a. m.	do	S	Light	37	49	38	Cloudy.
17	10 a. m.	do	SSE	Light	53	62	44	Fair.
18	10 a. m.	do	NE	Strong	35	30	28	Rain.
19	10 a. m.	do	NE	Fresh	30	36	32	Fair.
20	10 a. m.	do	E	Fresh	32	35	28	Snow.
21	10 a. m.	do	SE	Fresh	35	43	32	Cloudy.
22	10 a. m.	do	SW	Light	30	45	40	Fair.
23	10 a. m.	do	S	Light	34	48	39	Fair.
24	10 a. m.	do	W	Fresh	42	57	34	Cloudy.
25	10 a. m.	do	SW	Light	28	44	32	Cloudy.
26	10 a. m.	do	W	Light	34	38	34	Cloudy.
27	10 a. m.	do	NW	Light	37	40	30	Cloudy.
28	10 a. m.	do	NW	Light	28	36	25	Cloudy.
March 1	10 a. m.	do	NW	Strong	24	28	20	Cloudy; schooner Driver arrived, and was enabled to get up the river as far as McCormick's reaper factory.
2	10 a. m.	do	W	Strong	23	30	28	Cloudy.
3	10 a. m.	do	NE	Fresh	32	38	31	Fair.
4	10 a. m.	do	NW	Fresh	24	43	30	Fair.
5	10 a. m.	do	W	Light	25	32	20	Cloudy.
6	10 a. m.	do	E	Light	22	24	8	Snow.
7	10 a. m.	do	W	Fresh	0	10	8	Cloudy.
8	10 a. m.	do	SW	Fresh	— 2	20	6	Snow; river frozen over again down to its mouth.
9	10 a. m.	do	W	Fresh	12	28	9	Cloudy.

	10	10 a. m.	do	S	Light	15	30	26	Fair.
	11	10 a. m.	do	SW	Light	10	22	8	Fair.
	12	10 a. m.	do	SW	Light	— 2	15	8	Fair.
	13	10 a. m.	do	N	Fresh	20	26	15	Fair.
	14	10 a. m.	do	NW	Fresh	12	36	10	Fair.
	15	10 a. m.	do	E	Light	15	38	12	Fair.
	16	10 a. m.	do	SW	Light	30	42	28	Cloudy.
	17	10 a. m.	do	E	Light	26	40	32	Rained steadily all day, which melted the snow, and caused a high freshet and a strong rush of water down the river. This opened the harbor for the season.
	18	10 a. m.	do	NE	Strong	29	41	30	Snow; schooner Liberty arrived.
	19	10 a. m.	do	E	Light	26	35	28	Cloudy; steamer Huron departed for Twin rivers.
	20	10 a. m.	do	SE	Light	22	38	25	Fair.
	21	10 a. m.	do	SW	Strong	30	45	42	Rain; heavy thunder and lightning.
	22	10 a. m.	do	NW	Strong	32	46	35	Fair.
	23	10 a. m	do	W	Fresh	34	50	42	Rain.
	24	10 a. m.	do	W	Fresh	40	48	30	Fair; two vessels arrived.
	25	10 a. m.	do	NW	Fresh	36	45	33	Fair.
	26	10 a. m	do	NNW	Fresh	32	44	31	Fair; steamer Huron sunk inside of the piers; ran foul of an old wreck.
	27	10 a. m.	do	W	Light	36	48	40	Fair.
	28	10 a. m.	do	NW. by W	Fresh	35	40	34	Fair.
	29	10 a. m.	do	SE	Fresh	26	31	28	Cloudy.
	30	10 a. m.	do	SW	Light	30	37	26	Fair.
	31	10 a. m.	do	NW	Fresh	24	28	24	Rain.
April	1	10 a. m.	do	NE	Strong; a gale.	20	24	18	Cloudy; several vessels missed the harbor in entering, and were wrecked; 16 lives were lost; the crew of the schooner Gesine, eight in number, were saved by seven sailors who volunteered their services to man the government life-boat and rescued them.
	2	10 a. m.	do	NNE	Strong	20	26	18	Cloudy.
	3	10 a. m.	do	SW	Fresh	24	30	20	Fair.

* Tide-gauge frozen tight at north pier head, and no further records were made at the water works.

NOTE.—Average height, per tide-gauge, for five days in February, 1857, 2.13.

A 4—Continued.

Date.	Time of observation of the tide-gauge, & the winds and weather.	Surface of lake, per tide-gauge, in feet and decimals.	Wind.		Temperature of the external air, (Fahrenheit.)			Remarks.
			Course.	Strength.	6 h. a. m.	12 h. noon.	10 h. p. m.	
1857.					°	°	°	
April 4	10 a. m.	*Tide-gauge frozen	SW	Fresh	22	26	18	Rain.
5	10 a. m.	do	NW	Fresh	20	28	22	Cloudy.
6	10 a. m.	do	SE	Fresh	28	32	19	Snow.
7	10 a. m.	do	SSW	Strong	26	31	18	Snow.
8	10 a. m	do	NW	Fresh	24	40	36	Fair.
9	10 a. m.	2. 20	SE	Light	38	44	39	Fair. Tide-gauge free from ice; it was thawed out with salt.
10	10 a. m.	3. 10	SSE	Strong	27	34	30	Snow.
11	10 a. m.	3. 80	WNW	Strong	28	26	22	Snow.
12	10 a. m.	2. 50	W	Light	30	62	42	Fair.
13	10 a. m.	2. 45	SE	Fresh	40	38	32	Snow.
14	10 a. m.	2. 85	W	Fresh	30	60	28	Fair.
15	10 a. m.	2. 60	W	Strong	20	44	30	Cloudy.
16	10.20 a. m.	2. 20	W	Fresh	26	48	24	Cloudy.
17	10.10 a. m.	2 30	ESE	Light	20	38	29	Fair.
18	10.30 a. m.	2. 75	NNE	Fresh	33	50	38	Snow.
19	10.10 a. m.	2. 78	W	Light	36	48	34	Fair.
20	10 a m.	2. 50	SE	Light	38	56	34	Fair.
21	10.10 a. m.	3. 60	NE	Strong	35	50	30	Cloudy.
22	10.25 a. m.	3. 65	NNW	Strong	34	48	38	Fair.
23	10.30 a. m.	3. 55	N	Fresh	38	46	40	Fair.
24	10 a. m.	2. 45	NW	Light	36	48	42	Fair.
25	10.15 a. m.	2. 30	NNW	Light	43	50	46	Fair.
26	10.20 a. m.	2. 50	NW	Fresh	36	48	40	Rain.
27	9.30 a. m.	2. 35	WNW	Light	38	49	36	Fair.
28	9.35 a. m.	2. 20	S	Gentle	38	51	36	Fair.
29	10.10 a. m.	2. 35	SE	Light	39	52	37	Fair.

	30	10 a. m	2.65	SE	Light	38	50	40	Cloudy.
May	1	10.20 a. m	2.90	SE	Light	42	56	40	Rain.
	2	10 30 a. m	3.10	NE	Light	43	54	44	Fair.
	3	9.15 a. m	3.00	SE	Gentle	42	50	40	Fair.
	4	10 a. m	3.37	NE	Strong	43	50	38	Rain.
	5	9 a. m	3.40	ENE	Fresh	42	48	46	Fair.
	6	10 20 a. m	2.75	ENE	Gentle	43	52	47	Fair.
	7	10.30 a. m	2.90	ENE	Gentle	45	56	54	Fair.
	8	9 35 a. m	3 35	SSE	Fresh	58	60	57	Fair.
	9	9 a. m	3.00	S	Strong	58	80	54	Fair.
	10	8.50 a. m	3.20	NE	Fresh	50	45	32	Cloudy.
	11	8.15 a. m	2.95	SE	Light	40	48	45	Fair.
	12	8 a. m	2.80	SE	Light	42	60	50	Fair.
	13	8.45 a. m	3.25	ESE	Fresh	40	55	44	Rain.
	14	8.50 a. m	3.10	SE	Fresh	48	60	46	Rain.
	15	8.35 a. m	3.28	NW	Fresh	48	58	44	Cloudy.
	16	8.10 a. m	3.20	NNW	Fresh	47	57	45	Fair.
	17	8.30 a. m	3.36	NW	Fresh	48	58	46	Fair.
	18	8 a. m	3.54	NW. by N	Strong	50	58	48	Fair.
	19	10 a. m	3.80	N	Strong	52	58	50	Fair.
	20	3 p. m	3.30	N	Fresh	50	62	55	Fair.
	21	8.15 a. m	2.85	N	Light	52	70	60	Fair.
	22	9 a. m	2.80	WSW	Light	62	74	65	Cloudy.
	23	9.20 a. m	2.80	W	Light	75	80	73	Fair.
	24	8.35 a. m	2.95	SW. by S	Gentle	78	82	75	Fair.
	25	8.10 a. m	2.70	S	Fresh	76	80	70	Cloudy.
	26	8 a. m	2.80	SW	Light	72	82	75	Rain.
	27	9.15 a. m	2.70	SW	Light	70	72	74	Fair.
	28	9.10 a. m	2.80	W	Light	76	80	75	Fair.
	29	9 a. m	2.86	SW	Fresh	73	78	69	Fair.
	30	8.15 a. m	2.95	SE	Fresh	72	80	77	Rain.
	31	8 a. m	3.50	SW	Light	74	79	72	Fair.
June	1	10 a. m	2.95	SE	Fresh	78	82	79	Cloudy.
	2	9.15 a. m	2.85	WSW	Fresh	74	85	70	Cloudy.
	3	10.10 a. m	3.10	W	Light	68	77	70	Fair.
	4	8 a. m	3.15	W	Light	72	80	68	Fair.

*Tide-gauge frozen tight at north pier head, and no further records were made at the water works.

NOTE.—Average height, per tide-gauge, for 22 days in April, 1857, 2.71 feet. Average height, per tide-gauge, for the month of May, 1857, 3.07 feet.

A 4—Continued.

Date.	Time of observation of the tide-gauge, & the winds and weather.	Surface of lake, per tide-gauge, in feet and decimals.	Wind.		Temperature of the external air, (Fahrenheit.)			Remarks.
			Course.	Strength.	6 h. a. m.	12 h. noon.	10 h. p. m.	
1857.					°	°	°	
June 5	9 a. m.	3.32	SSE.	Light	68	70	69	Fair.
6	8 a. m.	2.90	SSW.	Fresh	72	82	76	Fair.
7	8.15 a. m.	2.85	W.	Light	76	84	72	Rain.
8	7.30 a. m.	2.50	W.	Light	70	78	74	Cloudy.
8	11 a. m.	3.80	WSW.	Fresh				Cloudy.
9	10 a. m.	3.60	SW.	Fresh	72	77	68	Fair.
10	8.15 a. m.	3.55	NNW.	Fresh	65	75	68	Rain.
11	9.10 a. m.	3.40	W.	Fresh	70	78	72	Fair.
12	9 a.m.	3.25	SW.	Light	74	76	70	Fair.
13	9.30 a. m.	3.28	NE.	Light	62	68	70	Cloudy.
14	9 a. m.	3.80	SSE.	Fresh	68	72	74	Showery.
14	11.20 a. m.	2.88	SSE.	Fresh				Showery.
15	9.10 a. m.	3.95	SSE.	Fresh	68	74	70	Cloudy.
16	9 a. m.	4.10	SW.	Fresh	75	88	76	Cloudy.
17	8.15 a. m.	4.00	SW.	Fresh	65	69	68	Showery.
18	8 a. m.	3.95	SW.	Fresh	60	66	64	Showery.
19	9 a. m.	3.90	SSW.	Fresh	70	72	68	Showery.
20	9.30 a. m.	3.85	SW.	Fresh	65	68	71	Showery.
21	9 a. m.	3.30	W.	Light	70	76	68	Fair.
22	9.15 a. m.	3.45	SW.	Light	60	69	65	Fair.
23	9.10 a. m.	3.50	E.	Fresh	70	78	72	Fair.
24	9 a. m.	3.82	SE.	Light	74	80	76	Cloudy.
25	9.10 a. m.	3.58	SE.	Light	78	82	76	Fair.
26	9.30 a. m.	3.70	E.	Gentle.	79	84	78	Fair.
27	9.45 a. m.	3.50	SE.	Gentle.	76	80	72	Fair.
28	9 50 a. m.	3.60	N.	Light	74	82	76	Fair.
29	10 a. m.	3.65	N.	Light	73	78	74	Fair.

	30	9. 15 a. m.	3. 70	W.	Fresh	75	78	73	Fair.
July	1	9 a. m.	3. 80	NNW.	Fresh	70	64	62	Cloudy.
	2	10 a. m.	4. 15	NE.	Strong	58	59	56	Cloudy.
	3	9 a. m.	4. 20	NNE.	Fresh	60	64	62	Fair.
	4	9. 30 a. m.	3. 80	NE.	Light	58	72	65	Fair.
	5	9. 25 a. m.	3. 46	NE.	Light	66	70	72	Fair.
	6	9. 45 a. m.	3. 40	W.	Fresh	70	74	72	Rain.
	7	9 a. m.	3. 50	WSW.	Light	70	76	72	Fair.
	8	9. 45 a. m.	3. 68	NW. by W.	Gentle	74	80	78	Fair.
	9	10 a. m.	3. 73	NW.	Light	76	78	76	Fair.
	10	9. 30 a. m.	3. 75	NE.	Light	74	80	72	Fair.
	11	9. 45 a. m.	3. 80	NNE.	Light	70	78	76	Fair.
	12	10 a. m.	3. 80	W.	Light	78	89	80	Rain.
	13	9. 30 a. m.	3. 78	NW.	Fresh	76	80	77	Cloudy.
	14	9 a. m.	3. 75	W.	Light	79	82	76	Showery.
	15	9. 35 a. m.	3. 82	NE.	Fresh	64	68	70	Cloudy.
	16	9. 40 a. m.	3. 80	NNE.	Light	66	70	72	Fair.
	17	9. 10 a. m.	3. 85	W.	Gentle	78	86	88	Fair.
	18	9 a. m.	3. 75	W.	Light	79	88	76	Fair.
	19	9. 20 a. m.	3. 86	W.	Light	78	88	80	Fair.
	20	9. 15 a. m.	3. 84	NW.	Light	76	80	79	Fair.
	21	9. 40 a. m.	3. 76	W.	Fresh	72	78	77	Fair.
	22	9. 35 a. m.	3. 80	W.	Fresh	80	84	81	Fair.
	23	9. 30 a. m.	3. 75	SW.	Fresh	82	86	80	Fair.
	24	9. 10 a. m.	3. 85	NW.	Light	78	88	86	Fair.
	25	9. 25 a. m.	3. 85	S.	Light	87	92	88	Fair.
	26	9. 40 a. m.	3. 75	SSW.	Light	84	88	86	Fair.
	27	9. 15 a. m.	3. 85	SE.	Light	84	87	86	Rain.
	28	9 a. m.	3. 80	S.	Light	85	90	88	Fair.
	29	9. 40 a. m.	3. 88	SE.	Light	79	84	80	Fair.
	30	9. 25 a. m.	4. 00	SW.	Light	78	86	82	Fair.
	31	9. 30 a. m.	4. 10	E.	Light	80	88	84	Fair.
Aug.	1	9. 40 a. m.	3. 88	SE.	Light	88	90	88	Fair.
	2	9. 10 a. m.	3. 86	W.	Light	86	89	85	Fair.
	3	9. 15 a. m.	3. 90	SW.	Light	84	88	80	Fair.
	4	9. 35 a. m.	4. 00	N.	Fresh	76	79	70	Showery.
	5	9. 30 a. m.	3. 85	NW.	Light	72	84	70	Fair.

NOTE.—Average height, per tide-gauge, for the month of June, 1857, 3. 46 feet; for the month of July, 1857, 3. 80 feet.

A 4—Continued.

Date.	Time of observation of the tide-gauge, & the winds and weather.	Surface of lake, per tide-gauge, in feet and decimals.	Wind.		Temperature of the external air, (Fahrenheit.)			Remarks.
			Course.	Strength.	6 h. a. m.	12 h. noon.	10 h. p. m.	
1857.					°	°	°	
Aug. 6	9. 25 a. m.	3. 80	WNW.	Gentle	73	80	74	Fair.
7	9. 10 a. m.	4. 10	S.	Gentle	76	79	74	Fair.
8	9. 15 a. m.	4. 15	NNW.	Light	76	86	74	Fair.
9	9. 40 a. m.	4. 12	W.	Light	80	84	81	Fair.
10	9. 10 a. m.	4. 10	SW.	Light	84	88	80	Fair.
11	9. 15 a. m.	4. 10	SW.	Light	79	82	81	Fair.
12	9. 35 a. m.	3. 80	SSW.	Fresh	82	88	86	Fair.
13	9. 30 a. m.	3. 85	SW.	Fresh	88	90	86	Fair.
14	9. 10 a. m.	4. 00	NW.	Fresh	76	80	74	Fair.
15	9. 15 a. m.	4. 45	NW.	Fresh	74	78	76	Fair.
16	9. 40 a. m.	4. 30	NE.	Strong	70	74	72	Rain.
17	9. 45 a. m.	4. 25	NW.	Fresh	75	80	78	Fair.
18	9. 30 a. m.	4. 20	W.	Fresh	74	79	76	Fair.
19	9. 35 a. m.	4. 32	NE.	Fresh	77	82	74	Cloudy.
20	9. 00 a. m.	4. 25	NW.	Fresh	75	82	76	Fair.
21	9. 40 a. m.	4. 15	W.	Fresh	74	78	72	Fair.
22	12 m.	4. 20	NW.	Light	68	76	72	Cloudy.
23	12 m.	4. 10	NW.	Fresh	78	86	81	Fair.
24	12 m.	3. 90	S.	Fresh	79	84	80	Fair.
25	12 m.	3. 85	SE.	Fresh	76	80	76	Fair.
26	12 m.	3. 85	S.	Fresh	80	88	76	Cloudy.
27	12 m.	4. 35	W.	Fresh	74	89	70	Cloudy.
28	10. 15 a. m.	3. 80	NW.	Light	64	78	66	Fair.
29	10 a. m.	3. 36	W.	Light	60	76	70	Fair.
30	9. 25 a. m.	3. 38	SW.	Gentle	60	86	72	Fair.
31	0. 30 p. m.	3. 38	WSW.	Light	65	80	75	Fair.
Sept. 1	10. 30 a. m.	3. 90	W.	Fresh	72	79	68	Fair.

2	10. 15 a. m.	3. 96	SW	Fresh	67	80	74	Fair.
3	10 a. m.	3. 88	S. by E	Gentle	68	77	70	Fair; clouds cirrus, quantity 4.
4	10 a. m.	3. 76	S by W	Gentle	70	79	68	Fair; clouds cirrus, quantity 4.
5	10 a. m.	3. 71	W	Gentle	66	78	69	Fair; clouds cirrus S., cumulus N., stratus W., and nebula E., quantity 10. After making these observations it rained, the wind blew quite fresh, and the lake became rough.
6	10 a. m.	4. 04	NE. by N	Fresh	70	74	70	Fair; clouds cumulus, quantity 3.
7	10 a. m.	3. 97	E. by S.	Fresh	68	76	72	Cloudy; clouds stratus, quantity 7.
8	10 a. m.	3. 80	SE.	Gentle	67	74	70	Fair; clouds cumulus, quantity 5.
9	10 a. m.	3. 58	SW	Gentle	72	80	74	Fair; clouds cumulus, quantity 1.
10	10 a. m.	3. 54	SW	Gentle	78	83	75	Fair; clouds stratus, quantity 0.
11	9. 15 a. m.	3. 59	WSW	Fresh	75	82	74	Fair; clouds cumulus, quantity 8.
12	9. 40 a. m.	3. 62	SE.	Fresh	74	83	76	Cloudy.
13	8. 15 a. m.	3. 80	SW	Gentle	75	82	74	Fair.
14	9. 30 a. m.	3. 75	SW	Gentle	76	80	72	Fair.
15	10. 20 a. m.	4. 10	NW	Gentle	68	84	75	Fair.
16	10. 10 a. m.	4. 00	NW	Fresh	74	82	76	Thunder storm.
17	10. 20 a. m.	4. 38	W	Strong	72	80	74	Cloudy.
18	10 a. m.	4. 45	NE	Strong	70	78	69	Cloudy.
19	9. 30 a. m.	4. 30	NE	Strong	64	76	65	Rain.
20	9. 15 a. m.	4. 28	NE	Fresh	62	74	66	Fair.
21	9. 40 a. m.	4. 25	N	Light	60	70	58	Cloudy.
22	9. 35 a. m.	4. 20	WSW	Light	60	75	56	Showery.
23	9 a. m.	3. 45	SW	Fresh	54	73	64	Fair.
24	10. 20 a. m.	3. 52	SW	Light	58	82	74	Fair.
25	9. 35 a. m.	3. 47	WSW	Fresh	62	86	73	Fair.
26	9. 50 a. m.	3. 50	SW	Light	64	89	76	Fair.
27	9. 10 a. m.	3. 56	SW	Light	72	86	70	Fair.
28	9. 30 a. m.	3. 60	NW	Fresh	64	80	58	Fair.
29	8. 35 a. m.	3. 66	W	Fresh	60	68	60	Cloudy.
30	9. 15 a. m.	3. 58	ESE	Fresh	54	69	64	8 p. m., rain.

NOTE.—Average height per tide-gauge for the month of August, 1857, 3. 99 feet; for the month of September, 1857, 3. 84 feet.

A 5.

A register of the relative heights and fluctuations of the surface of Chicago river, from observations made under the direction of Lieut. Col. J. D. Graham, on a permanent tide-gauge fixed at the south landing of the Free Ferry, opposite to Rush street, (see map G, No. 38, or G, No. 43,) in the city of Chicago, between April 1, 1856, and September 30, 1857.*

[NOTE.—The zero (0) or plane of reference of this tide-gauge is on the same level or horizontal plane with that of the tide-gauge at the extremity of the north pier of Chicago harbor.]

Date.	Time of observation.	Surface Chicago river, per tide-gauge, in feet and decimals.	Wind.		Remarks.
			Course.	Strength.	
1856.					
April 1	5 p. m.	2. 60	S	Light	
2	1 p. m.	2. 50	SW	Fresh	
3	1 p. m.	2. 65	W	Light	
4	1 p. m.	2. 60	N	Fresh	
5	1 p m.	2. 40	E	Light	
6	1 p. m.	2. 70	SE	Light	
7	1 p. m.	2. 60	E	Light	
8	1 p. m.	2. 40	SE	Fresh	
9	1 p. m.	2. 60	W	Fresh	
10	1 p. m.	2. 50	NE	Light	
11	1 p. m.	2. 60	S	Fresh	
12	1 p. m.	3. 05	N	Fresh	
13	1 p. m.	2. 65	NE	Light	
14	1 p. m.	2. 80	E	Fresh	
15	1 p. m.	2. 75	S	Fresh	
16	1 p. m.	2. 80	SW	Light	
17	1 p. m.	2. 30	W	Light	
18	1 p_m.	2. 70	W	Light	
19	1 p. m.	3. 30	N	Fresh	
20	1 p. m.	2. 90	N	Light	
21	1 p. m.	3. 00	N	Light	
22	1 p. m.	2. 60	S	Light	
23	1 p. m.	2. 60	NE	Light	
24	1 p. m.	2. 65	N	Light	
25	1 p. m.	2. 90	E	Light	
26	1 p. m.	3. 10	S	Fresh	
27	1 p. m.	2. 50	S	Fresh	
28	1 p. m.	2. 70	SW	Light	
29	1 p. m.	2. 65	NE	Light	
30	1 p. m.	3. 45	E	Fresh	

NOTE.—Average height per tide-gauge for the month of April, 1856, 2. 72 feet.

* After the record of December 5, 1856, the tide-gauge was removed and placed on the south side, and near to the west end of the ice-breaker attached to the middle pier of the new Rush street bridge. It was carefully placed so that the zero (0) of the scale was in the same horizontal plane, or level, as before. The first observation made upon it in this new position was on the 1st of April, 1857. J. D. G.

A 5—Continued.

Date.	Time of observation.	Surface Chicago river, per tide-gauge, in feet and decimals.	Wind.		Remarks.
			Course.	Strength.	
1856.					
May 1	1 p. m.	3.40	S.	Light	
2	1 p. m.	3.20	W.	Light	
3	1 p. m.	3.30	N.	Light	
4	1 p. m.	3.50	NE.	Fresh	
5	1 p. m.	3.20	NE.	Fresh	
6	1 p. m.	3.40	NE.	Fresh	
7	1 p. m.	3.15	NE.	Fresh	
8	1 p. m.	3.10	N.	Light	
9	1 p. m.	2.90	E.	Light	
10	1 p. m.	2.85	SE.	Light	
11	1 p. m.	2.80	W.	Light	
12	1 p. m.	3.25	N.	Fresh	
13	1 p. m.	3.30	E.	Fresh	
14	1 p. m.	3.10	SW.	Light	
15	1 p. m.	2.90	W.	Light	
16	1 p. m.	3.95	N.	Fresh	
17	1 p. m.	2.95	N.	Fresh	
18	1 p. m.	3.10	N.	Light	
19	1 p. m.	3.00	W.	Light	
20	1 p. m.	3.10	N.	Light	
21	1 p. m.	3.35	NE.	Light	
22	1 p. m.	2.75	SE.	Light	
23	1 p. m.	2.70	S.	Light	
24	1 p. m.	3.00	N.	Light	
25	1 p. m.	2.95	N.	Light	
26	1 p. m.	2.85	SW.	Light	
27	1 p. m.	3.50	NW.	Fresh	
28	1 p. m.	2.90	NE.	Light	
29	1 p. m.	3.10	N.	Light	
30	1 p. m.	3.00	NE.	Light	
31	1 p. m.	2.70	SW.	Fresh	
June 1	1 p. m.	2.75	S.	Light	
2	1 p. m.	3.80	S.	Light	
3	1 p. m.	3.40	S.	Light	
4	1 p. m.	2.65	W.	Light	
5	1 p. m.	3.00	E.	Light	
6	1 p. m.	3.25	E.	Light	
7	1 p. m.	3.10	W.	Light	
8	1 p. m.	3.20	N.	Light	
9	1 p. m.	3.10	NE.	Light	
10	1 p. m.	2.95	E.	Light	
11	1 p. m.	3.20	S.	Light	
12	1 p. m.	2.80	W.	Fresh	
13	1 p. m.	3.00	W.	Light	
14	1 p. m.	2.95	W.	Light	
15	1 p. m.	3.10	NE.	Light	
16	1 p. m.	3.10	SE.	Light	
17	1 p. m.	2.80	SW.	Light	
18	1 p. m.	3.20	N.	Light	
19	1 p. m.	3.20	SE.	Light	

NOTE.—Average height, per tide-gauge, for the month of May, 1856, 3.10 feet.

A 5—Continued.

Date.	Time of observation.	Surface Chicago river, per tide-gauge, in feet and decimals.	Wind.		Remarks.
			Course.	Strength.	
1856.					
June 20	1 p. m.	2.50	SE	Light	
21	1 p. m.	2.75	SW	Fresh	
22	1 p. m.	3.10	S	Light	
23	1 p. m.	3.50	SE	Light	
24	1 p. m.	3.25	SW	Light	
25	1 p. m.	3.45	SE	Light	
26	1 p. m.	3.20	S	Fresh	
27	1 p. m.	3.40	E.	Light	
28	1 p. m.	3.20	SW	Fresh	
29	1 p. m.	2.90	SW	Light	
30	1 p. m.	3.25	E.	Light	
July 1	1 p. m.	3.35	NE.	Light	
2	1 p. m.	3.60	S	Light	
3	1 p. m.	3.10	SW	Light	
4	1 p. m.	3.25	N.	Fresh	
5	1 p. m.	3.20	SW	Light	
6	1 p. m.	3.50	NE.	Fresh	
7	9 a. m.	3.45	NE	Fresh	
8	9 a. m.	3.43	N	Light	
9	9 a. m.	3.30	SE	Calm	
10	9 a. m.	3.45	E	C'm gentle	
11	9 a. m.	3.35	SE	Fresh	
12	9 a. m.	3.10	W	Stiff	
13	9 a. m.	3.27	SW	Light	
14	9 a. m.	3.20	SE	Light	
15	9 a. m.	3.25	SE.	Light	
16	9 a. m.	3.18	S	Moderate	
17	9 a. m.	2.96	W	Light	
18	9 a. m.	2.80	WNW	Fresh	
19	9 a. m.	3.10	NW.	Fresh	
20	9 a. m.	3.30	NE.	Calm	
21	9 a. m.	3.20	SE	Calm	
22	9 a. m.	3.15	E.	Calm	
23	9 a. m.	3.00	E	Moderate	
24	9 a. m.	3.24	E.	Moderate	
25	9 a. m.	3.22	S	Fresh	
26	9 a. m.	3.15	SW	Fresh	
27	9 a. m.	3.10	SW	Moderate	
28	9 a. m.	3.00	SW	Fresh	
29	9 a. m.	3.20	W	Fresh	
30	9 a. m.	3.28	WSW	Moderate	
31	9 a. m.	3.15	SW	Moderate	
Aug. 1	9 a. m.	3.18	S	Fresh	
2	9 a. m.	3.00	SW	Fresh	
3	9 a. m.	2.80	SE	Light	
4	9 a. m.	2.98	NW.	Light	
5	9 a. m.	3.30	NE	Light	
5	9 a. m.	3.10	E.	L ght	
7	9 a. m.	3.10	NE	Light	

NOTE.—Average height, per tide-gauge, for the month of June, 1856, 3.77 feet. Average height, per tide-gauge, for the month of July, 1856, 3.22 feet.

A 5—Continued.

Date.	Time of observation.	Surface Chicago river, per tide-gauge, in feet and decimals.	Wind.		Remarks.
			Course.	Strength.	
1856.					
Aug. 8	9 a. m.	3. 20	NE	Light	
9	9 a. m.	3. 00	NE	Light	
10	9 a. m.	2. 85	SW	Light	
11	9 a. m.	2. 65	SE	Light	
12	9 a. m.	2. 40	NE	Light	
13	9 a. m.	2. 43	NW	Light	
14	9 a. m.	3. 00	SE	Light	
15	9 a. m.	3. 10	E	Fresh	
16	9 a. m.	3. 00	E	Light	
17	9 a. m.	2. 85	SW	Light	
18	9 a. m.	2. 93	SE	Light	
19	9 a. m	2. 90	E	Light	
20	9 a. m.	2. 92	NE	Fresh	
21	9 a. m.	2. 84	SE	Light	
22	9 a. m.	2. 80	S	Fresh	
23	9 a. m.	3 00	NW	Light	
24	9 a. m.	3. 10	NW	Fresh	
25	9 a. m.	3. 20	NE	Strong	
26	9 a. m.	3. 25	NE	Moderate	
27	9 a. m.	2. 84	SE	Fresh	
28	9 a. m.	2. 80	SW	Light	
29	9 a. m.	3. 10	NE	Fresh	
30	9 a. m.	2. 65	NW	Light	
31	9 a. m.	2. 73	NE	Light	
Sept. 1	9 a. m.	2. 57	SW	Fresh	
2	9 a. m.	2. 66	ENE	Light	
3	9 a. m.	2. 60	E	Light	
4	9 a. m.	2. 45	SW	Fresh	
5	9 a. m.	2. 64	SE	Fresh	
6	9 a. m.	2. 75	SE	Fresh	
7	9 a. m.	2. 65	SW	Fresh	
8	9 a. m.	2. 60	SW	Light	
9	9 a. m.	2. 56	SE	Fresh	
10	9 a. m.	2. 60	S	Fresh	
11	9 a. m.	2. 75	SW	Light	
12	9 a. m.	2. 80	SW	Fresh	
13	9 a. m.	2. 70	SSW	Fresh	
14	9 a. m.	2. 74	NW	Light	
15	9 a. m.	3. 00	NE	Fresh	
16	9 a. m.	2. 65	ENE	Moderate	The tide-guage read at 11.20 a. m., 1.97; at 0.15 p. m. 3.62; at 1.30 p. m., 1.85; at 4.10 p. m. 2.05; and at 6 p. m., 3.94 feet.
17	9 a. m.	2. 45	SW	Fresh	
18	9 a. m.	1. 85	W	Strong	
19	9 a. m.	1. 90	W	Fresh	
20	9 a. m.	1. 35	NW	Moderate	
21	9 a. m.	2. 80	WNW	Strong	
22	9 a m.	2. 85	NW	Strong	
23	9 a. m.	3. 00	NW	Fresh	
24	9 a. m.	2. 85	W	Fresh	
25	9 a. m.	2. 00	SW	Strong	

NOTE.—Average height, per tide-gauge, for the month of August, 1856, 2.94 feet. Average height, per tide-gauge, for the month of September, 1856, 2.55 feet.

A 5—Continued.

Date.	Time of observation.	Surface Chicago river, per tide-gauge, in feet and decimals.	Wind.		Remarks.
			Course.	Strength.	
1856.					
Sept. 26	9 a. m.	2.70	W	Light	
27	9 a. m.	2.55	W	Fresh	
28	9 a. m.	2.62	SW	Light	
29	9 a. m.	2.45	NW	Light	
30	9 a. m.	2.42	NW. by N	Fresh	
Oct. 1	9 a. m.	2.30	NE	Light	
2	9 a. m.	2.00	SE	Light	
3	9 a. m.	2.42	SE	Light	
4	9 a. m.	2.80	SW	Light	
5	9 a. m.	2.05	SW	Light	
6	9 a. m.	1.64	NNW	Fresh	
7	9 a. m.	2.60	NW	Fresh	
8	9 a. m.	2.62	N	Fresh	
9	9 a. m.	2.62	NNW	Strong	
10	9 a. m.	2.61	SW	Light	
11	9 a. m.	2.65	NNW	Fresh	
12	9 a. m.	2.90	NW	Fresh	
13	9 a. m.	3.20	N	Fresh	
14	9 a. m.	3.95	NNW	Strong	
15	9 a. m.	2.82	N	Strong	
16	9 a. m.	2.64	NW	Light	
17	9 a. m.	2.60	NW	Moderate.	
18	9 a. m.	2.60	E	Moderate.	
19	9 a m.	2.80	W	Light	
20	9 a. m.	2.76	S	Light	
21	9 a. m.	2.53	SE	Light	
22	9 a. m.	2.40	WNW	Light	
23	7 a. m.	3.87	NW	Strong	
23	9 a. m.	3.96	NW	Strong	
23	11 a. m.	3.05	NW	H'vy blow	
23	12 m.	2.50	NW	H'vy blow	
23	4 p. m.	2.70	NW	H'vy blow	
24	9 a. m.	3.80	NE	Strong	
24	11 a. m.	3.40	NE	Strong	
24	2 p. m.	3.70	NE	Moderat'g	
24	5 p. m.	3.75	NE	Moderate.	
25	9 a. m.	3.00	NE	Light	
26	9 a. m.	2.56	SE	Fresh	
27	9 a. m.	2.20	SW	Light	
28	9 a. m.	2.05	SW	Light	
29	9 a. m.	1.80	WSW	Fresh	
30	9 a. m.	1.72	WNW	Fresh	
31	9 a. m.	1.70	SW	Light	
Nov. 1	9 a. m.	2.01	W	Fresh	
2	9 a. m.	2.23	SW	Light	
3	9 a. m.	2.96	NE	Strong	
4	9 a. m.	3.43	ENE	Fresh	
5	9 a. m.	3.40	SW	Light	
6	9 a. m.	1.54	S	Strong	
6	12.15 p. m.	1.32	S	Strong	

NOTE.—Average height, per tide-gauge, for the month of October, 1856, 2.56 feet.

A 5—Continued.

Date.	Time of observation.	Surface Chicago river, per tide-gauge, in feet and decimals.	Wind.		Remarks.
			Course.	Strength.	
1856.					
Nov. 6	3. 30 p. m.	1. 40	S.	H'vy blow	
6	5. 10 p. m.	1. 38	S.	H'vy blow	
7	9 a. m.	2. 00	S.	Fresh	
8	9 a. m.	2. 15	SW.	Fresh	
9	9 a. m.	2. 35	S.	Fresh	
10	9 a. m.	2. 26	SW. by S.	Light	
11	9 a. m.	2. 55	W.	Calm	
12	9 a. m.	2. 30	W.	Calm	
13	9 a. m.	2. 43	SW.	Calm	
14	9 a. m.	2. 39	W.	Calm	
15	9 a. m.	2. 20	S.	Light	
16	9 a. m.	2. 22	W.	Fresh	
17	9 a. m.	2. 25	NW.	Light	
18	9 a. m.	2. 26	NW.	Light	
19	9 a. m.	2. 40	SE.	Light	
20	9 a. m.	2. 45	E.	Fresh	
21	9 a. m.	2. 50	E.	Strong	
22	9 a. m.	2. 20	SW.	Light	
23	9 a. m.	2. 10	SE.	Fresh	
24	9 a. m.	2. 50	W.	Light	
25	9 a. m.	2. 80	E.	Fresh	
26	9 a. m.	2. 40	W.	Fresh	
27	9 a. m.	2. 20	SW.	Light	
28	9 a. m.	2. 40	S.	Fresh	
29	9 a. m.	2. 62	W.	Fresh	
30	9 a. m.	2. 00	SW.	Light	
Dec. 1	9 a. m.	2. 40	SW.	Light	
2	9 a. m.	3. 94	NE.	Strong	
2	10 p. m.	4. 20	----------	----------	
3	9 a. m.	3. 92	W.	Fresh	
4	9 a. m.	2. 55	W.	Fresh	
5	9 a. m.	2. 50	NW.	Light	
6	9 a. m.	Frozen	NW.	Light	

NOTE.—Average height, per tide-gauge, for the month of November, 1856, 2. 38 feet; for 5 days in December, 1856, 3. 09 feet.

A 5—Continued.

[By a tide-gauge placed on the south side and near the west end of the ice-breaker of the middle pier of the new Rush street bridge.]

NOTE.—The zero or plane of reference of this tide-gauge was carefully placed on the horizontal plane or level of the zero of the ferry gauge.

Date.	Time of observation.	Surface Chicago river, per tide-gauge, in feet and decimals.	Wind.		Remarks.
			Course.	Strength.	
1857.					
April 1	6. 15 p. m.	2. 85	NE.	Strong; a gale.	
2	8 a. m.	2. 65	W.	Strong	
3	8 a. m.	2. 00	W.	Fresh	
4	8 a. m.	2. 08	SW.	Fresh	
5	8 a. m.	2. 60	NW.	Fresh	
6	8 a. m.	2. 35	SE.	Fresh	
7	8 a. m.	2. 15	SSW.	Fresh	
8	8 a. m.	2. 30	NW.	Fresh	
9	8 a. m.	2. 10	SE.	Light	
10	8. 30 a. m.	3. 30	SE.	Strong	
10	5 p. m.	4. 00		Strong	
11	8 a. m.	4. 10	WNW.	Strong	
12	9. 15 a. m.	2. 70	W.	Light	
13	9. 30 a. m.	2. 60	SE.	Fresh	
14	9 a. m.	2. 98	W.	Fresh	
15	8. 10 a. m.	2. 72	W.	Strong	
16	8 a. m.	2. 45	W.	Fresh	
17	9. 15 a. m.	2. 50	ESE.	Light	
18	9. 20 a. m.	2. 85	NNE.	Fresh	
19	8. 30 a. m.	2. 98	W.	Light	
20	8. 40 a. m.	2. 75	SE.	Light	
21	9 a. m.	3. 65	NE.	Strong	
22	9 a. m.	3. 78	NNW.	Strong	
23	8. 15 a. m.	3. 70	N.	Fresh	
24	8. 20 a. m	2. 58	NW.	Light	
25	8. 35 a. m.	2. 55	NNW.	Light	
26	9 a. m.	2. 70	NW.	Fresh	
27	9. 10 a. m.	2. 85	WNW.	Light	
28	9 a. m.	2. 56	S.	Gentle	
29	8. 15 a. m.	2. 84	SE.	Light	
30	8 a. m.	3. 00	SE.	Light	
May 1	9 a. m.	3. 20	S.	Light	
2	9. 10 a. m.	2. 80	NE.	Light	
3	9. 30 a. m.	2. 95	S.	Gentle	
4	8. 25 a. m.	3. 50	NE.	Strong	
4	4 p. m.	3. 85		Strong	
5	8. 15 a. m.	3. 52	ENE.	Fresh	
6	9 a. m.	3. 00	ENE.	Gentle	
7	10 a. m.	3. 10	ENE.	Gentle	
8	10. 20 a. m.	3. 40	SSE.	Fresh	
9	10 a. m.	3. 10	S.	Strong	
10	9. 30 a. m.	3. 35	NE.	Fresh	
11	9. 15 a. m.	3. 10	SE.	Light	
12	9 a. m.	3. 00	SE.	Light	

NOTE.—Average height, per tide-gauge, for the month of April, 1857, 2. 79 feet.

A 5—Continued.

Date.	Time of observation.	Surface Chicago river, per tide-gauge, in feet and decimals.	Wind.		Remarks.
			Course.	Strength.	
1857.					
May 13	9.30 a. m.	3.50	ESE.	Fresh	
13	4 p. m.	3.85		Fresh	
14	9.10 a. m.	3.20	SW.	Fresh	
15	9.20 a. m.	3.40	NW.	Fresh	
16	9 a. m.	3.25	NNW.	Fresh	
17	9.15 a. m.	3.45	NW.	Fresh	
18	9.20 a. m.	9.65	NW by W.	Strong.	
19	9.35 a. m.	3.95	N.	Strong	
20	10 a. m.	3.40	N.	Fresh	
21	9.10 a. m.	3.00	N.	Light	
22	11 a. m.	3.20	WSW.	Light	
23	10.30 a. m.	3.00	W.	Light	
24	10 a. m.	3.10	SW. by S.	Gentle.	
25	9.15 a. m.	2.85	S.	Fresh	
26	9 a. m.	2.90	SW.	Light	
27	9.20 a. m.	2.85	SW.	Light	
28	10.35 a. m.	2.96	W.	Light	
29	9.30 a. m.	2.95	SW.	Fresh	
30	9.15 a. m.	3.10	SE.	Fresh	
31	9.10 a. m.	3.60	SW.	Light	
June 1	9.20 a. m.	3.40	SE.	Fresh	
2	8 a. m.	3.50	WSW.	Fresh	
3	9.15 a. m.	3.40	W.	Light	
4	10 a. m.	3.40	W.	Light	
5	9.30 a. m.	3.45	SSE.	Light	
6	9.10 a. m.	3.10	SSW.	Fresh	
7	9 a. m.	3.00	S.	Light	
8	8.45 a. m.	4.30	W.	Light	
8	8 p. m.	2.84	WSW.	Fresh	
8	10.30 p. m.	3.85	WSW.	Fresh	
9	9 a. m.	3.75	SW.	Fresh	
10	9.15 a. m.	3.70	NNW.	Fresh	
11	8 a. m.	3.60	W.	Fresh	
12	8.30 a. m.	3.15	SW.	Light	
13	8 a. m.	3.10	NE.	Light	From June 13 to 15 there was a strong current in the river; the tide-gauge during this time reading frequently 2.40 feet.
14	8.15 a. m.	3.65	SSE.	Fresh	
15	8.10 a. m.	3.70	SSE.	Fresh	
15	11 a. m.	2.40	SSE.	Fresh	
16	8 a. m.	3.84	SW.	Fresh	
17	7.30 a. m.	4.15	SW.	Fresh	
18	7.15 a. m.	4.15	SW.	Fresh	
19	7.30 a. m.	4.00	SSW.	Fresh	
20	7.45 a. m.	3.90	SW.	Fresh	
21	7.35 a. m.	3.45	W.	Light	
22	7 a. m.	3.60	SW.	Light	
23	7.10 a. m.	3.55	E.	Fresh	
24	7.15 a. m.	4.00	SE.	Light	
25	8 a. m.	3.70	SE.	Light	
26	8. 25 a. m.	3.85	E.	Gentle.	

NOTE.—Average height, per tide-gauge, for the month of May, 1857, 3.22 feet.

A 5—Continued.

Date.	Time of observation.	Surface Chicago river, per tide-gauge in feet and decimals.	Wind.		Remarks.
			Course.	Strength.	
1857.					
June 27	8 a. m.	3.60	SE	Gentle	
28	8.15 a m	3.75	N.	Light	
29	9.20 a. m	3.80	N	Light	
30	8.40 a. m	3.85	N.	Fresh	
July 1	8.10 a. m	3.70	NW by W.	Fresh	
1	6.50 a. m	4.50	NE.	Strong.	
2	8.35 a. m	4.35	NE.	Strong	
3	8.15 a. m	4.20	NE.	Fresh	
4	8 a. m.	3.80	ENE	Light	
5	8.15 a. m	3.68	NE.	Light	
6	8 a. m	3.70	W.	Fresh	
7	8.15 a. m	3.72	WSW	Light	
8	8 a. m	3.80	NW by W.	Gentle.	
9	9 a. m	3.92	NW.	Light	
10	9 a. m	3.95	NE.	Light	
11	8.15 a. m	4.00	NNE	Light	
12	8 45 a m	3.95	W.	Light	
13	8.15 a. m	3.70	NE.	Fresh	
14	8. a. m	4.00	W.	Light	
15	8.30 a. m	4.30	NE.	Fresh	
16	8.15 a. m	3.95	NNE	Light	
17	8 a. m	3.94	W.	Gentle.	
18	8.25 a. m	3.96	W.	Light	
19	8 a. m	2.96	W.	Light	
20	8.30 a. m	4.00	NW.	Light	
21	8.10 a. m	3.95	W.	Fresh	
22	8.30 a. m	3.88	W.	Fresh	
23	8.15 a. m	3.87	SW	Fresh	
24	8.45 a. m	4.00	NW.	Light	
25	8.30 a. m	4.05	S.	Light	
26	8 a. m	4.00	SSW	Light	
27	8.15 a. m	4.10	SE	Light	
28	8 a. m	4.00	S.	Light	
29	8.10 a. m	4.03	SE	Light	
30	8.45 a. m	4.15	SW	Light	
31	8.15 a. m	4.18	E.	Light	
Aug. 1	8 a. m	4.10	SE	Light	
2	8.10 a. m	4.00	W.	Light	
3	8.15 a. m	4.08	SW	Light	
4	8.30 a. m	4.10	N.	Fresh	
5	8.10 a. m	4.00	NW.	Light	
6	8.25 a. m	3.90	WNW	Gentle.	
7	8.15 a. m	3.88	S.	Gentle	
8	8.10 a. m	3.88	NNW	Light	
9	8.45 a. m	3.86	W.	Light	
10	8 a. m	3.90	SW	Light	
11	8.10 a. m	3.96	SW	Light	
12	8.40 a. m	3.94	SSW	Fresh	

NOTE.—Average height, per tide-gauge, for the month of June, 1857, 3 60 feet. Average height, per tide-gauge, for the month of July, 1857, 3.97 feet.

A 5—Continued.

Date.	Time of observation.	Surface Chicago river, per tide-gauge, in feet and decimals.	Wind.		Remarks.
			Course.	Strength.	
1857.					
Aug. 13	8. 10 a. m.	3. 90	SW.	Fresh.	
14	8. 40 a. m.	3. 98	NW.	Fresh.	
15	8. 35 a. m.	4. 55	NW.	Fresh.	
16	8. 15 a. m.	4. 50	NE.	Strong.	
17	8. 45 a. m.	4. 40	NW.	Fresh.	
18	8. 30 a. m.	4. 35	W.	Fresh.	
19	8. 45 a. m.	4. 28	NE.	Fresh.	
20	8. 10 a. m.	4. 30	NW.	Fresh.	
21	8. 25 a. m.	4. 30	W.	Fresh.	
22	11. 30 a. m.	4. 00	NW.	Light.	
23	11. 30 a. m.	4. 00	NW.	Fresh.	
24	11. 30 a. m.	4. 10	S.	Fresh.	
25	11. 30 a. m.	4. 15	SE.	Fresh.	
26	11. 30 a. m.	4. 00	S.	Fresh.	
27	0. 20 p. m.	4. 50	W.	Fresh.	
28	9. 20 a. m.	3. 90	NW.	Light.	
29	9. 35 a. m.	3. 70	W.	Light.	
30	9. 15 a. m.	3. 48	SW.	Gentle.	
31	9. 20 a. m.	4. 00	WSW.	Light.	
Sept. 1	10 a. m.	4. 20	W.	Fresh.	
2	9. 40 a. m.	4. 10	SW.	Fresh.	
3	10 a. m.		SE.	Gentle.	The readings of the tide-gauge on the 3d, 4th, and 5th, were not taken.
4	10 a. m.		SW.	Gentle.	
5	10 a. m.		W.	Gentle.	
6	10 a. m.	4. 22	NE. by N.	Fresh.	
7	10 a. m.	4. 15	E. by S.	Fresh.	
8	10 a. m.	4. 01	SE.	Gentle.	
9	10 a. m.	3. 76	SW.	Gentle.	The readings on the 9th, 10th, and 11th, are only approximate, as weeds defaced the tide-gauge.
10	10 a. m.	3. 76	SW.	Gentle.	
11	9. 15 a. m.	3. 76	WSW.	Fresh.	
12	9 a. m.	4. 20	SE.	Fresh.	
13	9. 15 a. m.	4. 25	SW.	Gentle.	
14	10 a. m.	4. 22	SW.	Gentle.	
15	10 a. m.	4. 50	NW.	Gentle.	
16	10. 40 a. m.	4. 35	NW.	Fresh.	
17	10 a. m.	4. 00	W.	Strong.	
18	9. 30 a. m.	4. 70	NE.	Strong.	
19	9 a. m.	4. 45	NE.	Strong.	
20	8. 40 a. m.	4. 48	NE.	Fresh.	
21	8. 30 a. m.	4. 35	N.	Light.	
22	9 a. m.	4. 36	WSW.	Light.	
23	8. 35 a. m.	3. 70	SW.	Fresh.	
24	9. 45 a. m.	3. 68	SW.	Light.	
25	10 a. m.	3. 67	WSW.	Fresh.	
26	9. 25 a. m.	3. 72	SW.	Light.	
27	8. 40 a. m.	3. 74	SW.	Light.	
28	8. 35 a. m.	3. 80	NW.	Fresh.	
29	8 a. m.	3. 82	SW.	Fresh.	
30	8. 30 a. m.	3. 87	ESE.	Fresh.	

NOTE.—Average height, per tide-gauge, for the month of August, 1857, 4. 06 feet.
NOTE.—Average height, per tide-gauge, for the month of September, 1857, 4. 07 feet.

A 6.

No. 188.] OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, September 19,1857.

SIR: The accompanying letter, (see A 7,) addressed, under date of the 8th of June last, to the honorable the Secretary of War, by Messrs. William B. Ogden, Edwin H. Sheldon, Stanley H. Fleetwood, and Van H. Higgins, of Chicago, was, about the time of its date, placed open in my hands, with a request that I would peruse it, and then forward it with such remarks as a due regard for the public interests, as well as for those of thc corporators therein named might seem to require, for the consideration and decision of the War Department. This I expected to be able to do before this time, but have been prevented by the current duties of my office, and the time it has necessarily taken to examine the subject in its bearings upon the interests of the general commerce, for whose benefit these harbor works have been constructed by the United States.

The act of incorporation granted to the company composed of the above named gentlemen by the legislature of the State of Illinois, on the 12th of February last, is hereto attached, marked A 8. A perusal of it will best explain the object of the company in making the request contained in the letters of the 8th of June to the Secretary of War.

For a more full understanding of the subject, I beg leave to refer to the map of Chicago harbor and bar, marked G., No. 43, lately forwarded from this office to the Bureau of Topographical Engineers. The area proposed to be improved is bounded on the west by the dotted line on the aforesaid map, marked "Lake Shore of 1833, as per the map of Kinzie's addition," and on the east by the present lake shore, or such breakwater as the company may choose to erect to the east thereof, under the conditions specified in the 4th section of their charter. The whole improvement is to be on the north side of Chicago river, and adjacent to the United States north pier of Chicago harbor.

The hydraulic principles which apply, as tending to affect the character of the river for navigation, are the same in this case as those which are expressed in my report No. 34, to the Topographical Bureau of the 4th of September, 1854. This report will be found in the paper marked A 15, in the printed Senate (Executive) Document No. 16, of the 34th Congress, 3d session, now in the library of the War Department.—(See pages 51 to 53.)

After careful observations which I have again made upon the direction and force of the river current, I cannot perceive that the granting of the request of the Chicago Dock and Canal Company to be permitted to make an opening through the UnitedStates north pier of Chicago, harbor, in the manner proposed in the letter of the 8th of June last, can be in any way detrimental to the harbor or to the public interests, *provided* it be done under similar conditions and limitations to those which were specified and agreed to in the case of a like permission granted in 1855 to the Illinois Central Railroad Company.

These conditions and limitations will be found printed in the aforesaid Senate document, in the paper marked A 16, pages 58 to 62. It

should be further provided that no ship basin, harbor, or canal, which may have a water communication through the proposed opening in the north pier, with the Chicago river, shall, at any time, or under any circumstances whatever, have any other water communication with the said river, nor with Lake Michigan, without the express consent, previously obtained in writing, from the War Department of the United States, upon such further conditions as may be mutually assented to and agreed upon.

Also, that any basin, harbor, or canal, that may be made to communicate through the said opening in the north pier, with the Chicago river or Lake Michigan, shall be rendered water tight at all other points than at the said opening, by means of such substantial crib work or close piling as shall be approved of by the Topographical Bureau and sanctioned by the War Department of the United States, the parapets or coping of which should rise from five to seven feet above the level of the lake surface at its high water stage, according to the proximity of said works to the shore of Lake Michigan.

Also, that no works constructed by said company shall interfere with, or encroach upon the position which, previous to the charter granted by the State of Illinois to said company, was chosen and adopted by the Light-house Board of the United States for the erection of the new light-house for Chicago harbor, the said position being in Lake Michigan, adjacent to, and on the north side of the east extremity of the United States north pier of Chicago harbor.

The said position will be seen by reference to maps G, Nos. 9 and 43, filed in the Bureau of Topographical Engineers, and sheet marked G, No. 39, filed in the office of the Light-house Board, at Washington, with a report from Lieutenant Colonel J. D. Graham, upon the position and construction of the said light-house, and its piers of defence, against the action of the lake-sea, dated July 26, 1856, and approved by the board on the 25th of October, 1856.

Also, that before proceeding to make the proposed opening in the north pier, the particular point chosen for it shall be reported to the Bureau of Topographical Engineers, and approved by the War Department.

In conclusion, I would respectfully recommend that the application of the company be granted upon their executing a bond to the United States, in the penal sum of two hundred thousand dollars, to observe and comply with the conditions and limitations herein above referred to and described.

I have here to repeat what was expressed in my report, No. 159, to the Bureau, dated August 28, 1856, that "slips or ship basins, if carefully planned, so as not to impair the navigation of the river, nor the entrance of the harbor, will prove great aids to the general commerce of the port of Chicago."

I have the honor to be, very respectfully, your obedient servant,

J. D. GRAHAM,
Major Topographical Engineers,
Brevet Lieutenant Colonel, Superintending Engineer.

Colonel J. J. ABERT,
Chief Topographical Engineers, Washington.

A 7.

CHICAGO, ILLINOIS, *June* 8, 1857.

SIR: Being the owners of the tract of land formed by accretions lying immediately north of, and adjoining the north pier of Chicago harbor, and having recently procured from the legislature of this State, a charter authorizing the construction of docks and canals in the lake and on said tract of land, and the entrances to the same from the Chicago harbor and river, and designing to improve said lands, as authorized by the terms of the charter, and desirous to do so in a manner that shall be acceptable and agreeable to the general government, by whom the said pier was erected, and in a manner that will not interfere with the plans of the general government for the improvement of said harbor, we have addressed this letter to you, with the view to get permission to cut through the north pier an entrance to our harbor and canals at such a point east of the west entrance to the Illinois Central Railroad harbor, not exceeding sixteen hundred feet east of said entrance, and also an entrance opposite the east entrance of said railroad harbor as shall be approved by Colonel Graham, or such other officer of the general government as they shall direct.

Similar permission has already been given to the Illinois Central Railroad Company to cut through the south pier, and both improvements are required to accommodate the rapidly increasing commercial interests of our city; and, as was justly said by the Illinois Central Railroad Company in applying for permission, "this improvement will, we think, in no way impair the objects of the general government in the construction of the pier, for the buildings, which will be erected at an early day outside of this basin, must be placed upon solid foundations; thus forming, without further expense to the government, a permanent protection to the river, which was the original object of the pier." Upon application to Colonel Graham, he has referred us to the War Department, and it will be esteemed a favor if you will, at your convenience, request Colonel Graham's report upon the subject, as our company desire to take immediate measures to complete the canals and docks so much needed in this city, and which our legislature have expressly authorized.

We have the honor to be, sir, your most obedient servants,

W. B. OGDEN,
EDWIN H. SHELDON,
STANLY H. FLEETWOOD,
VAN H. HIGGINS,
Corporators named in said charter, and owners of said land.

Hon. JOHN B. FLOYD,
Secretary of War.

A 8.

AN ACT to incorporate a company for the improvement by canals and harbors of the east part of Kinzie's addition to the city of Chicago.

SECTION 1. *Be it enacted by the people of the State of Illinois, represented in the general assembly*, That William B. Ogden, Van H. Higgins, Edwin H. Sheldon, and S. H. Fleetwood be, and they are hereby, constituted a body politic and corporate, to be called the "Chicago Dock and Canal Company," and by that name shall have perpetual succession, with power to sue and to be sued, plead and to be impleaded, in all courts of law and equity in this State.

SEC. 2. The officers of said company shall consist of a president, a secretary, a treasurer, and not less than three nor more than seven directors; all of said officers shall be elected annually by the stockholders of said company, and at such election each stockholder shall be entitled to one vote for every share owned by him or her.

SEC. 3. The capital stock of said company shall be divided into shares of one hundred dollars each, and may consist of any number of shares not exceeding thirty thousand; said company may be organized as soon as five thousand shares shall be subscribed for; and the further subscription to the capital stock of said company may be received from time to time as the board of directors may order and appoint: *Provided*, That the entire stock of said company shall not at any time exceed the thirty thousand shares above stated.

SEC. 4. Said company shall have the power to enclose, make and protect, and also to erect and construct, on their own lands, and on the shore, and in the navigable waters of Lake Michigan, so that they do not in any manner obstruct or prevent the free navigation of the same in front of their own lands and premises, and in front of the premises of such person or persons as may assent to the same, wharves, docks, moles, piers, breakwaters, and such other erections, protections, improvements, and conveniences for the safety and accommodation of boats and vessels, and the security and advantageous use of their own property, wharves and docks, or for the purposes of convenience in the use and enjoyment of said property by the said company, as the board of directors of said company may deem necessary and proper.

SEC. 5. Said company shall also have power to excavate, maintain, preserve, and keep open canals, basins, slips, and such other ways, with their embankments, supporters, and appurtenances, for the entrance of boats and vessels of all kinds from the lake, and also from the Chicago harbor and river, to every part of their property, lands, and premises, as may by the board of directors of said company be considered necessary and convenient for the profitable use and enjoyment of said property, and for the interests of said company.

SEC. 6. Said company shall also have power to buy at private or public sale, and to take and hold perpetually, any and all lands that may be necessary for the use and purpose of said company, and the

complete execution of the powers hereby conferred upon said company: *Provided*, The same shall lie and be situated in Kinzie's addition to the city of Chicago, and shall not exceed in all fifty acres of land exclusive of the land covered by water.

SEC. 7. For the purpose of better enabling said company to carry out the provisions of this act, it shall and may be lawful for said company, by their agents and servants, to enter upon, take possession of, and hold and use any such lots, pieces, or parcels of land in said Kinzie's addition, or adjacent thereto, as may be needful for the completion of the improvement hereby contemplated, and for the complete excercise of the powers herein conferred, and to take therefrom any materials which may be found thereon, for the erection and construction of such improvements: *Provided*, Said company shall pay the owners of lands so occupied by them as aforesaid, or from which such materials may be taken as aforesaid, the value of the land so occupied, or materials so taken, or the damages done thereto; and when the said company and the owners of said land or materials shall be unable to agree, as to the price and value of said lands or materials so taken, or damages done, said value shall be ascertained, or damages assessed, and compensation made in same manner as is now provided by law for assessing damages, &c., in case of public highways.

SEC. 8. The president, secretary, and treasurer of said company shall be *ex officio* directors of said company, and together with the directors chosen as herein before provided, shall constitute a board of directors, who are hereby vested with all the corporate powers of said company, and are authorized to make and establish all such by-laws, rules, and regulations for the management and direction of the affairs of said company, and the prosecution and completion of the work contemplated by this act, as they may deem necessary and proper.

SEC. 9. The corporators named in the first section of this act are hereby authorized, at any time within two years from the final passage of this act, by publishing a notice of their intention so to do in any newspaper printed in the city of Chicago, to open books for subscriptions to the capital stock of said company, at such place as they shall in said notice appoint; and when five thousand shares of said stock shall have been subscribed, said corporators shall, by like notice, appoint a time and place for the election of officers of said company.

SEC. 10. The board of directors shall have power to fill all vacancies which may occur in said board by death, resignation, removal, or other cause whatsoever; and shall, at least four weeks prior to the expiration of their term of office, give notice to the stockholders of said company, in such a manner as they shall prescribe in the by-laws of said company, of the time and place of holding the next annual election of officers for said company.

SEC. 11. Said company shall have power to lease their lands for such time and upon such terms as may be agreed upon between said company and its leasers, to levy a tax, or charge, or toll upon all boats or vessels passing through their canals or slips, or lying in their basins or harbors, or tying to, laying alongside of their docks or piers, or in any manner using or occupying the property of said company.

SEC. 12. The said corporation shall have power to vacate the streets

which pass through their own lands, and shall have power to use and the right to appropriate, for their canals and other purposes, so much of the east end of the several streets passing through so much of Kinzie's addition to the city of Chicago as lies between the lake shore and the west line of the land, formed by the accretion in said addition, and known as the "Sands:" *Provided*, Said corporation shall first purchase all the lands on each side of any street, so far as they may use or appropriate the same.

SEC. 13. This act shall take effect and be in force from and after its passage.

SAM'L HOLMES,
Speaker of the House of Representatives.
JOHN WOOD,
Speaker of the Senate.

Approved February 12, 1857.

WH. H. BISSELL.

THE UNITED STATES OF AMERICA, STATE OF ILLINOIS.

I, O. M. Hatch, secretary of state of the State of Illinois, hereby certify the foregoing to be a true copy of an enrolled law on file in my office.

In testimony whereof, I hereunto set my hand and affix the great seal of the State. Done at the city of Springfield this 18th day of February, A. D. 1857.

[L. S.]

O. M. HATCH, *Secretary of State.*

A 9.

No. 189.]

OFFICE GENERAL SUPERINTENDENCE, &C.,
Chicago, September 22, 1857.

SIR: The accompanying communication, marked A 10, was received in June last from the Chicago Dock and Canal Company. The request it contains is, that the general government will permit the said company to repair that portion of the United States north pier of Chicago harbor which lies adjacent to their grounds, in Kinzie's addition to the city of Chicago, on the north side of the harbor, constructed by the United States government, and to keep the same in repair, free of expense to the United States, and in a manner satisfactory to the government officers, on condition that the said company be permitted to use the said pier, when so repaired, as a dock to their lots for landing their property, and such goods, wares, merchandise, and chattels as may be desired to be landed.

When I was assigned to duty here in April, 1854, I found that the harbor piers had been much injured by the practice of using them as landing docks, and piling upon them heavy loads of lumber, bricks, railroad and pig iron, coal, cord wood, &c., It is true that the chief cause of their dilapidation was the effect of time, in causing a decay

of the timbers above the water surface; but it was evident that the injury had been much augmented by the practice above mentioned.

On examining the files of this office, I found these practices prohibited by your instructions to my predecessors, dated as far back as May 29, 1847, and August 31 and September 3, 1849.

They will be found printed in Senate Ex. Document No. 16, 34th Congress, third session, in papers marked A 18, 19, and 20, at pages 67 and 68. The duty clearly devolved on me, then, of requiring attention to those regulations.

This I endeavored to do in a manner that would protect the public piers from injury and at the same time afford reasonable facilities for crossing them, by all persons whose actual business occupations seemed to call for reasonable consideration and accommodation in this respect. I accordingly issued the regulations to be found, marked A 7, at page 47 of the same document. The whole subject will be found presented in my annual report of December 31, 1855, (No. 116,) at pages 31, 32 of the above mentioned printed Senate document.

More recently I have been obliged to call attention, through the newspapers and by printed posters, to the regulation against loading the piers, in the manner shown in the accompanying paper, marked A 11.

From continued decay and the want of appropriations for repairing the piers, they have fallen into a much worse condition than they were in at the time of my last annual report.—(See pp. 308 to 312 of the same Senate document.)

I am acquainted with all the gentlemen whose names are signed to the paper A 10, and who are the corporators under the act of the legislature of this State of February 12th last, a copy of which was forwarded with my communication, marked No. 188, of the 19th instant.* They are all citizens of the highest respectability here. The enterprise in which they are now about to engage under the State charter, while it will no doubt prove very profitable to them, will at the same time, if judiciously managed, prove to be a great aid to the general commerce carried on between the numerous lake ports and the port of Chicago.

The contemplated improvement will, when carried out, afford great relief to the over-crowded shipping which is constantly arriving at and departing from this port. It would seem, then, I would respectfully submit, desirable to afford to incorporated companies, as well as to individuals engaged in such improvements as this, every facility consistent with the preservation of the public piers under the jurisdiction of the general government, for the especial purposes for which they were constructed.

To transfer them as property, either to incorporated companies or to individuals, would not be consistent with this principle. If it were done in this instance, numerous applications would no doubt be made for the granting of similar requests at all the important lake ports where public piers have been constructed for the benefit of general commerce and navigation.

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* See document A 8, hereto attached.—J. D. G.

The most, therefore, which I feel justified in recommending is, that the company be permitted, if they choose, to repair the north pier opposite to their lots and grounds by furnishing the necessary means; *provided*, that the work shall be done under the direction and supervision of the officer of United States engineers in charge of said harbor improvement, or such other officer as the War Department may direct, and in accordance with such plan and specifications as shall be approved by the Bureau of Topographical Engineers, and sanctioned by the War Department; the funds of the company to be disbursed by an agent of their own, and not to be in any manner under the custody of the said officer of the United States engineers.

This arrangement, while it would preserve the character of the pier as adopted by the War Department, seems to be in accordance with the tenor and spirit of the War Department regulation of June 4, 1853, which will be found printed in the aforesaid Senate document, No. 16, at page 251, under the heading "E 44." If these conditions be accepted by the company, the War Department might, without injury to the piers or inconvenience to the public interests, extend the facilities for communicating across them between the river and the company's lots and grounds, by such specific regulations as it might choose to adopt, and thus the company would be remunerated for the expense of the repairs.

In the present condition of the piers, however, I do not think that the facilities provided for by the regulation contained in the accompanying paper marked "A 11" should be changed.

With these views I respectfully submit for the decision of the department the company's application, marked "A 10."

I am, very respectfully, sir, your obedient servant,

J. D. GRAHAM,
Maj. Top. Eng'rs, Bt. Lt. Col. Sup'g Eng'r, &c.

Colonel J. J. ABERT,
Chief Topographical Engineer, Washington.

A 10.

CHICAGO, ILLINOIS, *June* 8, 1857.

SIR: Being the owners of the tract of land formed by accretions, and lying immediately north of and adjoining the north pier of the Chicago harbor, and having leased several hundred feet of our said property to various persons, to be used for lumber yards and other purposes, and the pier being out of repair and in a state of decay above the water's edge, and not suitable either for a pier or docks, we desire permission (under the directions of the general government officer, if required) to rebuild the same above the water's edge, and permission to use the same as a dock front for our property. This will be of great service to our newly-formed company, and a great public benefit to the commerce of our city.

This improvement will strengthen and render more secure the piers

and harbor of Chicago. We are willing to do it in such a manner as shall be satisfactory to the government officers, and in no way hinder or obstruct or impair the objects of the general government in the construction of the pier, the original object of which was protection to the river.

We are willing to put in new timbers above the water where they are decayed, and also to keep the same in repair, as required, free of expense to the government, if we can be allowed to use the pier as a dock to our lots for landing our property and such goods, wares, merchandise, and chattels as may be desired to be landed.

It is believed that no valid objection can exist to granting our request, and that nothing is asked inconsistent wish the interests of the United States.

As we cannot use the property in its present condition, and as the officers under you have refused to allow us to interfere with the pier in any way, we have addressed this letter to you, hoping you may find it consistent with the interests of the United States government to grant us the permission desired, or if not in your own immediate power, that the proper consent through you may be obtained from the War Department. It will be esteemed a very great favor if you will give this matter attention at your earliest convenience.

Very respectfully, sir, your obedient servants,

W. B. OGDEN,
EDWIN H. SHELDON,
STANLY H. FLEETWOOD,
VAN H. HIGGINS,

Corporators named in the said charter and owners of said land.

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Colonel GRA[redacted],
Superintending Engineer, &c.

A 11.

Notice to masters of vessels and all others.

The piers for the protection of Chicago harbor having been much injured by depositing upon them lumber, wood, stone, iron, and other articles, notice is hereby given that it is contrary to the government rules to do so.

All persons are therefore prohibited from doing the like in future.

All persons possessing property of any description piled upon the harbor piers will please cause it to be removed therefrom without delay.

In cases where it may be absolutely necessary to cross the piers with materials, in order to reach points where they are actually to be used in building, &c., proper and reasonable facilities will, upon special application at this office, be granted for so doing, by passing them over in parcels, by hand in the case of lumber or timber, and in wheelbarrows or light hand-carts, running upon plank ways, in the case of stone, iron, and other heavy materials; the articles in all cases to be crossed clear over, and not deposited upon the piers.

It is made the duty of the inspector of the piers and watchman of the public property to visit them daily, to see that the rule is observed by all concerned.

J. D. GRAHAM,
Lieut. Colonel, Superintending Engineer.

OFFICE GEN. SUP. LAKE MICHIGAN WORKS,
Chicago, August 15, 1854.

The attention of all good citizens, and all persons interested, is earnestly called to the foregoing government regulations, and it is hoped that all persons having materials of any kind piled on the Chicago harbor piers will cause them to be removed forthwith, in compliance with said regulations.

J. D. GRAHAM,
Lieut. Colonel, Superintending Engineer.

OFFICE GEN. SUP. LAKE HARBOR WORKS,
Chicago, May 21, 1857.

A 12.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, November 11, 1857.

SIR: Your letters, Nos. 188 and 189, of the 19th and 22d September last, and the documents therein referred to, having been submitted to the War Department, were this day returned with the following endorsement:

"Approved, under the restrictions proposed by the corporators and Lieutenant Colonel Graham.

"J. B. FLOYD, *Secretary of War.*

"WAR DEPARTMENT, *November* 9, 1857."

Respectfully, sir, your obedient servant,

J. J. ABERT,
Colonel Corps Topographical Engineers.

Brevet Lieut. Col. J. D. GRAHAM,
Corps Topographical Engineers, Chicago, Illinois.

A 13.—*Equatorial intervals of wires in sidereal time of the small transit instrument by Newman, deduced from observed transits of the follow-lowing stars.*

I. ILLUMINATION EAST.

Names of stars.	Declination.	No. of observ'ns on each star.	From 1st to 3d wire.	From 2d to 3d wire.	From 3d to 4th wire.	From 3d to 5th wire.
	° ′ ″		s.	s.	s.	s.
η (Eta Bootis	19 07 00 N.	3	46.81	24.27	23.17	48.89
τ (Tau) Virginis	2 14 00 N.	4	46.70	24.12	23.09	48.29
δ (Delta) Leonis	21 18 00 N.	4	46.97	24.34	23.09	48.48
α (Alpha) Bootis	19 56 00 N.	1	-------	24.44	23.50	48.42
ρ (Rho) Bootis	31 00 00 N.	2	46.63	24.00	23.10	48.64
α^2(Alpha 2d) Libræ	15 27 00 S.	2	46.84	24.19	23.61	48.61
η (Eta) Virginis	00 08 00 N.	4	46.81	24.48	22.95	48.76
β (Beta) Corvi	22 36 00 S.	5	46.94	24.61	22.85	48.51
α (Alpha) Ursæ Minoris	88 32 45 N.	------	46.73	24.33	23.22	48.73
α (Alpha) Virginis	10 24 00 S.	5	46.96	24.48	23.26	48.88
η (Eta) Ursæ Majoris	50 02 00 N.	4	46.67	24.34	23.02	48.56
ζ (Zeta) Virginis	00 08 00 N.	4	46.83	24.19	22.79	48.88
γ^1 (Gamma 1) Virginis	00 40 00 S.	4	46.79	24.38	23.21	48.59
θ (Theta) Virginis	4 46 00 S.	2	46.81	24.15	23.15	48.50
β (Beta) Ursæ Minoris	74 44 00 N.	1	46.59	24.35	23.03	48.89
α (Alpha) Ursæ Majoris	62 31 00 N.	2	46.70	24.21	23.24	48.73
δ (Delta) Hydræ et Crateris	14 00 00 S.	4	46.76	24 32	23.20	48.70
β (Beta) Leonis	15 22 00 N.	4	46.80	24.41	23.22	48.59
γ (Gamma) Ursæ Majoris	54 29 00 N.	3	46.61	24.49	23.23	48.83
ε (Epsilon) Corvi	21 50 00 S.	3	46.94	24.59	22.87	48.54
γ (Gamma) Cephei (sub-polo)	76 50 00 N.	2	46.93	24.42	22.98	48.58
θ (Theta) Ophiuchi	24 51 00 S.	1	46.67	24.18	23.29	48.94
α (Alpha) Herculis	14 33 00 N.	1	46.88	24.56	23.19	48.63
β (Beta) Draconis	52 24 00 N.	1	46.80	24.35	23.28	48.81
51(Hevelius Cephei	87 15 30 N.	1	47.19	24.4	23.33	48.93
δ (Delta) Ursæ Minoris	86 35 45 N.	1	-------	24.37	-------	-------
μ (Mu) Herculis	27 48 00 N.	1	46.74	24.21	23.23	49.05
γ (Gamma) Draconis	51 30 00 N.	1	46.63	24.28	23.28	48.81
μ^1(Mu 1st) Sagittarii	21 06 00 S.	1	46.69	24.32	22.92	48.92
β (Beta) Lyræ	33 12 00 N.	1	46.23	-------	23.32	48.67
ζ (Zeta) Aquilæ	13 39 00 N.	1	46.96	24.65	-------	-------
ω (Omega) Aquilæ	11 20 00 N.	1	46.60	24.28	22.91	47.98
δ (Delta) Aquilæ	2 50 00 N.	1	46.87	24.44	23.12	48.77
Mean: sidereal intervals of wires			46.77	24.35	23.15	48.68
Log. of sidereal intervals			1.669967	1.386481	1.364551	1.687359
Log. constant, for converting sidereal into mean solar time			9.998813	9.998813	9.998813	9.998813
Log. of mean solar intervals			1.668780	1.385294	1.363364	1.686172
Intervals in mean solar time			46.64	24.28	23.09	48.55

I. With illumination *east*— s.

Mean of 1, 2, 3, 4, and 5 wires, —0.142 = middle or 3d wire.
Mean of 1, 3, and 5 wires, —0.637 = middle or 3d wire.
Mean of 2, 3, and 4 wires, +0.40 = middle or 3d wire.

II. With the illumination *west*, (or for *sub-polo* stars with the illumination *east*,) the corrections have the contrary sign.

A 14.

Determination of the values of the divisions on the scale of the level to the transit axis.

There are twelve (12) spaces to an inch, exactly, on the level scale. The level being lashed on the top of the telescope of the transit, their axis parallel. The object observed on was a graduated staff, placed perpendicular to the horizon, at a distance, accurately measured, of 181. 095 feet south of the middle or centre point of the transit axis.

N. division of level.	No. of observation.	The horizontal wire reads on staff.	Differ'ce of staff readings in feet.	The south end of bubble reads on south half of scale.	Differ'ce of level readings.	Differ'ce of staff readings in arc.	Value in arc of each division of level scale.
	1	2. 000 ft.				"	"
	2	1. 750 "	.250	+ 29. 0	33. 0	285. 7 arc.	8. 66
	3	1. 953 "	.203	4. 0	30. 0	231. 0 "	7. 7
	4	1. 850 "	.103	+ 26. 0	12. 5	117. 3 "	9. 38
	5	1. 765 "	.085	13. 5	12. 0	97. 0 "	8. 08
				1. 0			Mean = 8."45
						"	"
	6	1. 697 ft.		+ 29. 0		254. 0 arc.	7. 7
	7	1. 920 "	.223	— 4. 0	33. 0	207. 5 "	7. 54
	8	1. 738 "	.182	+ 23. 5	27. 5	82. 0 "	6. 8
	9	1. 810 "	.072	+ 11. 4	12. 1	94. 5 "	8. 3
	10	1. 893 "	.083	+ 00. 0	11. 4		Mean = 7."6
S. division of level.							

Mean value of each level division throughout the scale, 8″ of arc; or, in equatorial time, 0*s*.53.

A 15.

Observations of the error in level of the transit axis, made at Chicago at various times on the night of May 15, 1857, *by Lieutenant Colonel J. D. Graham.*

No. of determination.	Mean solar time of observation.	D for level direct, R for level reversed.	East end of level scale reads in divisions.	West end of level scale reads in divisions.	Level error. East arm too high.... — West arm too high... +		
					In divisions of level scale.	In arc.	In equatorial time.
	h. m.	D.	3.7	13.3		"	s.
1	7 26	R.	11.7	5.1	+ 0.625	+ 5.0	+ 0.33
		D.	4.0	12.9			
		R.	11.9	5.0			
		D.	7.2	13.1			
2	7 45	R.	12.4	5.3	— 0.375	— 2.7	— 0.18
		D.	7.1	13.3			
		R.	12.7	5.0			
		D.	5.5	12.5			
3	8 19	R.	13.7	4.1	— 0.50125	— 4.1	— 0.27
		D.	5.2	12.7			
		R.	13.5	4.5			
		D.	5.0	12.8			
4	8 45	R.	13.6	4.5	— 0.3125	— 2.5	— 0.17
		D.	4.9	13.1			
		R.	13.5	4.1			
		D.	4.8	13.3			
5	9 10	R.	13.5	4.7	+ 0.0375	+ 0.3	+ 0.02
		D.	4.6	13.5			
		R.	13.1	4.8			
		D.	4.8	14.0			
6	9 54	R.	13.3	5.8	— 0.425	— 3.4	— 0.23
		D.	4.7	13.9			
7	10 11	R.	12.9	5.8	+ 0.6375	+ 5.1	+ 0.34
		D.	4.4	14.0			
		R.	12.5	5.9			
		D.	5.5	15.8			
8	13 28	R.	14.0	6.2	+ 0.625	+ 5.0	+ 0.33
		D.	4.5	14.5			
9	13 43	R.	11.8	7.0	+ 1.175	+ 9.4	+ 0.63
		D.	4.0	13.7			
		R.	12.0	6.5			
		D.	5.0	14.0			
		R.	12.0	6.2			
10	13 59	D.	3.8	15.0	+ 0.77	+ 6.16	+ 0.41
		R.	13.5	5.0			
		D.	4.8	13.8			
		R.	12.0	6.3			

A 15—Continued.

No. of determination.	Mean solar time of observation.	D for level direct, R for level reversed.	East end of level scale reads in divisions.	West end of level scale reads in divisions.	Level error. East arm too high ---- — West arm too high --- +		
					In divisions of level scale.	In arc.	In equatorial time.
	h. m.					"	*s.*
11	14 10	D.	4.5	14.0	+ 0.525	+ 4.2	+ 0.28
		R.	13.0	4.3			
		D.	4.0	13.7			
		R.	12.3	6.0			
12	14.46	D.	5.0	15.0	+ 0.90	+ 7.2	+ 0.48
		R.	13.7	6.7			
		D.	5.0	15.0			
		R.	13.0	7.2			
13	15.02	D.	5.0	15.0	+ 0.6875	+ 5.5	+ 0.37
		R.	13.1	6.7			
		D.	5.2	14.7			
		R.	13.6	6.0			
14	15.28	D.	5.8	14.3	— 0.0375	— 0.3	— 0.02
		R.	14.3	5.9			
		D.	6.1	13.8			
		R.	14.0	5.9			
15	16.01	D.	6.1	14.3	+ 0.0125	+ 0.1	+ 0.01
		R.	14.1	6.1			
		D.	6.2	14.0			
		R.	14.0	6.1			

A 16.

Combinations of stars for computing the error in azimuth of the axis of the telescope of the transit instrument from the observations made at Chicago at various times of the night of the 15*th of May*, 1857, *by Lieutenant Colonel J. D. Graham.*

Time by mean solar chronometer of transit over the middle wire.	Pairs of stars.	Difference of N. P. D.	Azimuthal error in equatorial time.
h. m. s.		° ′ ″	*s.*
7 17 22.81	*a* Ursæ Majoris	76 31 37.	—1.5
7 34 40.18	*δ* Hydræ et Crateris		
7 55 52.84	*γ* Cephei, S. P	87 47 39.	—1.4
8 04 09.38	*β* Leonis		
8 08 39.70	*γ* Ursæ Majoris	36 57 47.	—2.9
9 29 52.60	*a* Ursæ Minoris, S. P		
8 08 39.70	*γ* Ursæ Majoris	54 21 41.	—2.5
8 34 54.88	*η* Virginis		
9 29 23.36	*a* Ursæ Minoris, S. P	101 52 00.	—2.42
9 39 49.24	*a* Virginis		
9 49 31.34	*ζ* Virginis	49 52 29.	—1.44
10 03 58.06	*η* Ursæ Majoris		
13 48 38.40	*β* Draconis	77 15 38.	—1.20
13 34 44.34	*θ* Ophiuchi		
14 14 39.35	*γ* Draconis	72 35 57.	—0.45
14 26 33.57	μ^1 Sagittarii		
14 39 55.5	*δ* Ursæ Minoris	6 08 55.	—0.24
14 53 09.86	51 Hev. Cephei, S. P		

2. WAUKEGAN BREAKWATER, ILLINOIS.

My annual report (No. 116) for the year 1855 contains my views, in full detail, in regard to the importance of this work, together with an estimate of its cost, amounting to $137,966 10.—See estimate marked B 3, at page 135 of Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session. A statement of the commerce and tonnage of Waukegan for the year 1855 was presented with that report, and will be found in the above mentioned document. The whole was accompanied by an illustrative map, showing the position and dimensions of the proposed work, and the depth of water it was designed to occupy. This map is in the Topographical Bureau, and is marked G, No. 29. I beg leave to refer to the said report and map as embodying all that I would present in relation to this work.

The funds formerly appropriated for this harbor are exhausted.

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3. KENOSHA HARBOR, WISCONSIN.

In regard to this harbor I ask a reference to the accompanying map, marked G, No. 53, which is presented in duplicate. It shows the condition of Kenosha harbor and bar, as derived from surveys made in May, 1857. The scale of this map is $\frac{1}{2400}$, or 200 feet to 1 inch. It should be printed on this scale.

The former appropriations made for this harbor having been exhausted in the year 1855, no work has been done there by the United States since that period, except a survey made in May last.

The importance of this harbor to the commerce of the lakes generally, as a port of refuge, and the great facilities afforded for extending its capacity, together with statistics showing the amount of its commerce and tonnage in the year 1855, and estimates of the cost of completing it, were all given in full detail in my annual report (No. 116) for that year. It will be found printed in Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session, from page 140 to page 180.

The amount now required to be appropriated to complete this harbor is the same as was then estimated—that is to say, $58,047 24.—(See page 151 of the same document.)

I still entertain the same opinions as were given in that report respecting this harbor.

I would also refer to the remarks contained in my annual report (No. 161) for the year 1856, to be found in the above mentioned document, at pages 338 and 339.

I ask particular attention to the last paragraph but one, respecting the curtailment, in length, of the mercantile pile wharfs alluded to in that and in my annual report for 1855.

4. RACINE HARBOR, WISCONSIN.

No work has been done by the United States at this harbor since the year 1854. During that year the small balance of the former appropriation appertaining to this work was expended in making an extension of the north pier by adding two cribs, each 32 feet long by 20 feet wide, and in dredging the channel between the piers.

No appropriation having been made by Congress in 1855 for the completion of this harbor, the citizens of the place determined in 1856 to push the work forward with their own means. During that year the south harbor pier was extended two hundred and twenty (220) feet by the addition of seven cribs. Six of these are each 32 feet long by 16 feet wide; the seventh or lakeward crib is 30 feet long by 20 feet wide. These cribs are not equal in quality to those added by the United States the year previous to the north pier. Those added in 1856 by the citizens were constructed in great part with hemlock timber, and although the bottoms were latticed by cross timbers, somewhat after our model, the open spaces thus formed were too small to admit a passage of the ballast stone through them to fill the vacancy caused by the washing away of the soil under the cribs, by the force of the river current, or that of the lake sea. The consequence was just what long experience has uniformly shown must take place. The cribs tilted inward, more or less, and some of them so much that they are much deteriorated in strength for durability, and for that which ought to be secured with a view to a stone superstructure above the water level at a future day. The tilting is now hidden by building up perpendicular above the water surface.

During the present season of 1857, the north pier has been likewise extended two hundred and twenty (220) feet lakeward, by adding seven cribs 20 feet wide, corresponding to the width of the cribs added to this pier by the United States in 1854. The alignment of this new work has not been preserved to correspond with that of the United States work. There is a considerable jog to the north in the new work at the junction, and from thence there is a uniform inclination of the new work inward or towards the river channel, so that the width between the extremities of the two piers is contracted about eighteen or twenty (18 or 20) feet. This new pier work is filled with ballast stone to the water level, and in some places two feet higher. This is sufficient, considering the depth of water the cribs occupy.

I would recommend that the north pier be extended ninety-six feet, and the south pier one hundred and ninety-two feet, requiring for the former three cribs, and for the latter six cribs, each 32 feet long, 20 feet wide, and of an average height of nineteen feet from the soil at bottom to the flooring at top.

I recommend that they be constructed in the manner suggested in my former report, to be found specified in the estimate marked D 4, at pages 190 and 191 of Senate (Ex.) Doc. No. 16 of the 34th Congress, 3d session.

The cost of each crib, by that estimate, will be $1, 812 71.

1. Then 9 cribs for the two piers, at $1,812 71 each, will cost	$16,314 39
2. For cheveaux-de-friese sand fender, as per estimate D 6, at page 192 of same document	630 00
3. For meteorological instruments, as per estimate D 7, same page of said document	232 50
4. For surveys of the harbor, (see estimate D 8, at page 193, same document)	245 84
Amount required for Racine harbor, Wisconsin	17,422 73

I recommend that this sum be granted in one appropriation.

The corporate authorities of Racine, in addition to the pier extensions described, have caused a large amount of dredging to be done in the harbor and on the outer bar, which has greatly improved this harbor.

There are now fourteen (14) feet depth of water on the outer bar, and not less than twelve feet inside, between the piers. In the river west of the piers the depth in the channel is still greater.

For a full account of this harbor, its tonnage and commerce, in the year 1855, I would refer to my report of that year, to be found printed at pages 180 to 199 of the aforesaid Senate document.

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5. MILWAUKIE HARBOR, WISCONSIN.

1. *The new harbor at the "North Cut."*

In my last annual report, (No. 161,) of November 15, 1856,* the progress made in the construction of this harbor was fully reported. It was therein stated that forty-three cribs, each thirty-two feet long and twenty feet wide, had been completed and sunk in position; and that 260 feet of pier work, ten feet wide, had been put down and secured for the support and protection of the sides of the cut to form this new connexion between Milwaukie river and Lake Michigan.

The length of pier work thus formed was, then:

1. For the north pier, (including the 260 feet of protection, ten feet wide at the sides of the cut)	932 feet.
2 For the south pier	704 feet.

There had then been removed, by dredging, from the cut and between the piers about 45,000 cubic yards of earth.

After the date of my last report, and before the season for work in 1856 closed, an additional crib, thirty-two feet long and twenty feet wide, was added to the south pier,† thus making the south pier 736 feet long.

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* See Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session, pages 340 to 342.

† In my report for 1856 it was stated that it would be added to the north pier, but afterwards it was decided to add it to the south pier.

All the above work was done by the city of Milwaukie, and at the expense of a fund raised by the corporation. It was, however, done under the general direction of this office, and under the immediate inspection and supervision of H. W. Gunnison, esq., United States harbor agent at Milwaukie. The cribs were all modeled and bolted, in conformity with the plans and specifications shown on the sheet of drawings marked G, No. 20, and in my annual report (No. 116) of December 31, 1855,* both of which are in the Topographical Bureau.

Active operations were resumed at this harbor on the 1st of May, 1857, and the work has been pushed forward with zeal during the whole season. The 1st, 2d, and 3d sections of the work had been completed, except the dredging, when the last crib was sunk in position in November, 1856. The time had therefore arrived with the opening of the season of 1857, in accordance with previous arrangements given in my annual report for 1855, for the United States to lay down the 4th or lakeward section of the pier work.

Accordingly, 5 cribs of 32 feet in length and 20 feet wide were added by the United States to the south pier. This was, however, only one-fourth part of the work necessary for completing the 4th section of the pier-work, because that section is, under the original division, 320 feet long, and required 20 cribs—that is to say, 10 for each pier. An estimate was submitted, with both my annual reports for 1855 and 1856, of funds necessary for the completion of this 4th section by the United States, amounting to $24,266 75.

No appropriation was, however, made for this object by Congress. The corporate authorities of the city of Milwaukie, therefore, determined that this valuable work, which had already progressed so far towards completion, should not fall short for want of the necessary means, and, with a laudable energy, that body raised an additional sum for the completion of this work. With the means thus raised by the city of Milwaukie, 23 cribs, each 32 feet long and 20 feet wide, have been added to the two piers this season, besides the 5 which were added by the United States; also, 240 feet, lineal, of crib work, 10 feet wide, have been put down the present season for the support and protection of the sides of the cut between the river and the lake.

The aggregate of work which has been done both by the United States and the city authorities of Milwaukie for the formation of this new harbor, from the commencement, in 1854, up to this time, is as follows, viz:

1. Thirty-four (34) cribs, each 32 feet long by 20 feet wide, have been put down to form the north pier, making the length of the north pier 1,088 feet.

2. Thirty-three (33) cribs of like dimensions have been put down to form the south pier, making its length 1,056 feet.

The direction of the harbor thus formed is north 81 degrees east, (*magnetic, in May*, 1854,) and the actual width of channel way between the interior faces of the piers is 260 feet.

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* See pages 16 to 18 of Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session; also pages 209 to 218; also, pages 224 to 241 of the same document.

Besides the above mentioned pier work, which is all situated lakeward of the original lake shore line, 300 feet lineal of pier work 10 feet wide have been put down for the support and protection of the north side of the cut, and 240 feet lineal of similar pier work have been put down for the protection of the south side of the cut.

The quantity of earth removed from the channel and the thorough cut from the commencement of the work to the present time is 75,966 cubic yards. Of this quantity 43,562 cubic yards have been removed with scoop dredging machines, at the expense of the city.

The United States steam-dredge for Lake Michigan has never been employed at Milwaukie until the present season. She commenced working for the harbor there on the 26th of June, 1857*. Between that date and September 30, 1857, inclusive, she has done the following work, viz:

1. Quantity of earth excavated and removed from the channel between the piers of the new harbor at the "north cut".....	14,260 cubic yards.
2. Quantity of earth excavated and removed from the middle ground in the river west of the "north cut".....	18,144 "
Total number of cubic yards excavated and removed from the new harbor at Milwaukie between the 26th of June and the 30th of September, 1857.....	32,404

Whenever the weather was too rough to dredge between the piers the machine was employed on the middle ground in the river. A detailed account of each day's work is hereto attached, marked B 2.

An effort is being made to complete the dredging between the piers the present season. That upon the bar off the entrance to this harbor must be done next year.

It is due to Agent H. W. Gunnison to state that he has carried out faithfully, and with zeal and ability, the instructions of this office in regard to the mode of constructing the piers for this new harbor. Being himself a civil engineer of ability, he readily appreciated the importance of doing the work thoroughly, as the best means of insuring durability, and hence I found him a valuable coadjutor.

These piers have been constructed throughout in strict accordance with the plan described from page 8 to page 18 of my report for 1855, as it is printed in Senate Ex. Doc. No. 16, of the 34th Congress, 3d session, and as illustrated by the drawings in sheet G, No. 20, now in the Topographical Bureau. It is the only fair opportunity I have had of constructing piers for a harbor throughout according to this plan. It will be for time to show how far this plan is calculated to insure durability for a work composed of a combination of timber, iron, and ballast stone. The open grillage or latticed bottoms for the cribs originated with the Topographical Bureau and the late Board of Engineers for Western Rivers and Lake Harbors, but no instructions were ever

* See instructions to the captain of the steam-dredge, dated July 1, 1857, hereto attached, marked B 1.

given in regard to the particular mode of combining the timbers to form them. This is, however, a detail that can be modified according to circumstances, such as the strength required to resist a greater or less force of the sea, &c.

The advantage of these open latticed bottoms is beautifully illustrated in this long double line of pier work. The number of cribs composing it is sixty-seven, (67,) each 32 feet long, and 20 feet wide, reaching out into the lake to a depth of 16 feet of water. Of the whole sixty-seven there are only two which do not set vertical in the water, showing the streaks, between the longitudinal timbers, parallel with the water line; of these two exceptions there is not one whose inclination, at the top timber, is more than fourteen (14) inches from a vertical plane rising from the bottom timber—the cribs being in 15 feet depth of water. So slight an inclination is scarcely a detriment, when it is considered that the neighboring cribs are not disturbed by it, because they are not interlocked, one with another, at their ends.*

In describing the settling and slight tilting of these two cribs, Agent Gunnison, in his monthly report to this office of September 1, 1857, says: "The twenty-eigth and twenty-ninth cribs of the south pier—sunk during the month of July last, and filled with stone above the water level—after remaining well in place nearly three weeks, commenced settling down and tilting inward, and continued to do so, in spite of the efforts of the contractors, until they had sunk down some two feet, and were fourteen (14) inches out of the perpendicular. The stones in the inner compartments of the cribs, in the meantime, settled considerably through the latticed bottoms. This settlement indicates a substratum of light alluvial soil at this point, similar to what was experienced last summer (1856) in placing a crib on the north side, nearer in to the shore, where some twenty-five or thirty (25 or 30) cords of stone were lost through the bottom of the crib before a solid foundation could be obtained."

I will add that a solid foundation was, however, obtained, and this crib brought to a level position at an additional expense of, say, thirty cords of stone, which cost two hundred and forty dollars, ($240.) It was certainly far better to encounter this additional expense in the beginning than to allow the crib to settle permanently out of allignment or adjustment, because it would then have constituted a weak point in the pier, and would have given rise to great trouble, besides a much greater expense, in after years, to keep the pier in proper repair at this point.

The quantity of wrought iron used in bolting together the timbers of these cribs has been, in accordance with the rule given in the table marked "T 2," at pages 16 and 17 of the above mentioned document, and in the drawings in sheet G, No. 20. It is as follows, depending on the depth of the water or height of the crib, viz:

1. For a crib in 10 feet depth of water.....	2,322	lbs.
2. For a crib in 12 feet " "	2,660	"
3. For a crib in 15 feet " "	3,167	"
4. For a crib in 16 feet " "	3,336	"
5. For a crib in 17 feet " "	3,505	"

*See from the last paragraph of page 6 to the first paragraph, inclusive, of page 7 o Senate Doc. No. 16, (Executive,) 34th Congress, 3d session.

Some persons may think this a great extravagance in iron for bolts, but I hold that experience has proved it a good economy in this sort of pier work, exposed as it is, from its locality, to the violent action of the lake sea, and hence requiring a corresponding degree of strength.

This bolt iron costs, on an average, four cents (4 cents) per pound, delivered anywhere on the lakes.

By estimate marked E 31, at pages 236 and 237 of the above mentioned printed document, it appears that one of these cribs, built in ten feet (10 feet) depth of water, costs.....	$1,578 45
The iron for its bolts, 2,660 lbs. cost only.....	106 40
The cost of a crib suited to a depth of 17 feet of water would be, under the same prices for materials and workmanship.....	2,048 71
The iron for its bolts would be 3,505 lbs., which, at 4 cents per lb., is	140 20

So that, notwithstanding this liberal use of iron for bolts, its costs, as given above, only six and three-fourths ($6\frac{3}{4}$) per cent. of the whole cost of the crib. It would seem, then, very injudicious to diminish in anywise the strength of the work for the sake of any reduction in this very small item of expense for the iron bolts.

It is due to Messrs. Hasbrouck & Conro, contractors with the corporate authorities of the city of Milwaukie, for supplying the materials and performing the work in the construction of this harbor, under the city appropriations, to say that they have zealously and faithfully carried out the plans of construction furnished by this office, and enjoined by the resolution of the common council of the city, passed on the 6th of August,* 1855, and they have always fully performed the work to the satisfaction of this office. The former contractor, Mr. C. D. Barton, having died soon after he took the contract, it was given by the city to Messrs. Hasbrouck & Conro, who entered actively upon their duties in the spring of 1856, and in two working seasons have very nearly completed the whole in a faithful, durable, and highly creditable manner.

The old harbor at the mouth of Milwaukie river.

The importance of keeping open the entrance to Milwaukie river at its natural mouth, and of keeping the piers erected there in good order, is fully explained in my annual report for 1855. Entertaining the same opinions now which were expressed in that report upon this subject, I beg leave to refer you to it,† and to the illustrative map submitted with it, marked G, No. 16.

The piers forming the harbor at the mouth of this river, so important as a port of refuge and anchorage to the commerce of the lakes generally, are in a state of dreadful dilapidation. If appropriations be not soon granted for their repair they must go to entire destruc-

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* See pp. 225 to 231 of Senate (Executive) Doc. No. 16 of the 34th Congress, 3d session. Also the resolution and proceedings of the council, at pp. 230, 231.

† See Senate (Executive) Doc. No. 16, of the 34th Congress, 3d session.

tion, and in that case, the mouth of the river, that is to say, its natural outlet, will become stopped up by the formation of a permanent bar across it. Already, a large amount of dredging is necessary, in addition to the repair of the piers, in order to save the harbor at this point. In my report of last year (No. 161) I submitted an estimate of funds then required for these purposes, amounting to $23,784 26. No appropriation was, however, granted for this work, and now the piers are in a condition requiring a much larger sum to repair them.

For these repairs I herewith submit an estimate (marked B 3) amounting to the sum of	$28,630 41
I also submit an estimate (marked B 4) for the dredging out of this old harbor, amounting to.....	11,710 85
Making a total required for the repairs and dredging of the old harbor at Milwaukie of	40,341 26

In order to the timely operations necessary to save this harbor, I would recommend the granting of the above amount in one appropriation.

B 1.

OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, July 1, 1857.

SIR: You are appointed captain and engineer of the United States steam-dredge now employed in dredging the channel at the straight cut of Milwaukie harbor.

Your duty will be to work and manage the dredge boat and her machinery, and also her four sand scows, with the same system which has heretofore been observed in dredging other harbors. While it is desirable that the dredge boat and her scows should be so managed as to accomplish the greatest quantity of work that can be judiciously done without injuring them, it is at the same time essential that neither should be overworked, or put to such a power of steam as would injure the buckets of the dredge boat, or cause the scows, while being towed by the steam-tug, to leak; and much care should be taken to avoid collisions with other vessels, and with wharves and docks.

You are held responsible to this office for a due regard to these instructions.

You will reside on board the dredge boat as heretofore. The watchman and four careful, sober, and reliable men, to be selected from the crew, will also reside on board, in order to be at hand to render assistance in case of fire, storms, or any other event requiring it.

The fire buckets belonging to the boat must be constantly kept on the deck, filled with water day and night, so as to be ready to extinguish fire, if needed. This rule must be very faithfully observed.

It will be the duty of the watchman to be always on the alert at

night, and to look to the safety of the vessel, especially against accidents from fire. In cases of apprehended danger of any kind, he will call you and the crew up, so that you may direct the proper steps for the safety of the dredge and her scows. He must, therefore, be allowed to rest during the day. Smoking must not be allowed on board the dredge.

Should the contractors choose to employ a cook and board the crew, so far as their meals are concerned, it may be done. In this case you will frequently inspect the cooking stove to see tnat there is due caution observed about the fire, and you will always see that the fire of this stove is thoroughly extinguished immediately after the serving of each meal.

You and all the crew will be paid every Saturday evening by the contractors, to whom you and all the crew are to look for your pay, and for which they alone are responsible.

You will make as soon as possible, and also on the 30th September next, a return to this office of all the rigging, tools, and other appurtenances belonging to the dredge, setting forth their condition, according to the forms furnished you in blank.

You will also, on the first and fifteenth of every month, make a report in writing to this office of the operations, stating the condition of the vessel and her machinery, and scows, and how she works, the number of cubic yards removed from the channel, and from the shoal in the river when it is reached, the nature of the soil excavated, and any other circumstances important to the dredging.

The dredge must never be left at any time without either yourself or the watchman being on board.

I am, respectfully, sir, your obedient servant,

J. D. GRAHAM,
Brevet Lieut. Col., Sup. Engineer.

Mr. CHARLES MYERS,
Now at Milwaukie, Wisconsin.

B 2.

Statement of the number of cubic yards of earth excavated and removed from the new harbor, (at the "North Cut,") and from the Middle Ground in the river west of the North Cut of Milwaukie, Wisconsin, by the United States steam-dredge for Lake Michigan, between the 26th of June and the 30th of September, 1857.

1. DREDGING BETWEEN THE PIERS AT THE "NORTH CUT."

Date.	Number of cubic yards excavated and removed.	Date.	Number of cubic yards excavated and removed.
1857.		1857.	
June 26	200	August 20	240
27	320	21	160
29	360	22	240
30	280	24	220
July 1	240	25	300
2	320	26	400
3	280	27	320
6	320	28	280
7	469	Sept. 1	260
8	480	2	240
9	440	3	260
10	400	4	300
11	420	9	320
13	320	10	380
14	440	11	320
15	400	12	300
August 3	320	14	320
6	240	15	400
7	280	17	320
10	300	21	320
12	400	22	200
13	320		
18	300	Total	14,260
19	320		

The soil between the new harbor piers at the "North Cut" is clay, sand, and coarse gravel. The clay is very hard; it requires much power to work it out of the channel; much more than on the middle ground.

B 2—Continued.

2. DREDGING ON THE MIDDLE GROUND IN THE RIVER, WEST OF THE "NORTH CUT."

Date.	Number of scow loads excavated and removed.	Number of cubic yards excavated and removed.	Date.	Number of scow loads excavated and removed.	Number of cubic yards excavated and removed.
1857.			1857.		
July 16	35	840	Aug. 31	30	720
17	29	696	Sept. 7	17	408
18	20	480	8	25	600
20	20	480	16	30	720
21	26	624	18	34	816
22	36	864	19	15	360
29	23	552	23	28	672
August 4	32	768	24	28	672
5	20	480	25	4	96
8	24	576	26	31	744
14	33	792	28	34	816
15	30	720	29	32	768
16	30	720	30	32	768
17	30	720			
29	28	672	Total	756	18,144

The soil of the middle ground is sand, mud, and soft clay. It is very easy to dig. Ten pounds pressure of steam will effect more work on the middle ground than twenty-five pounds will do in the north cut, between the new harbor piers.

J. D. GRAHAM,
Brevet Lieut. Col., Sup. Eng. Lake Harbor Works.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, September 30, 1857.

B 3.

Estimate of the cost of repairing the piers at the natural outlet of Milwaukie river.

1. Cost of repairing the north pier:

30,580 lineal feet of pine timber 12″ by 12″ square, at 16 cents per lineal foot	$4,892 80
110 M. of 3-inch plank, at $18 per M	1,980 00
24,350 pounds of wrought iron 1″ by 1″ square, for bolts, at 4 cents	974 00
3,280 pounds of spikes 6 inches long, and $\frac{3}{8}$ by $\frac{3}{8}$ of an inch square, at $7\frac{1}{2}$ cents per pound	246 00

200 cords of stone, at $9 per cord	$1,800 00
For tearing down and removing decayed and defective timber above the water level	1,750 00
Carpentry, labor, superintendence, office rent, &c.	4,325 00
Sum	15,967 80
Add 10 per cent. for contingencies	1,596 78
Amount required for repair of the north pier	17,564 58

2. Cost of repairing the south pier:

19,680 lineal feet of pine timber 12″ by 12″ square, at 16 cents per lineal foot	$3,148 80
65 M. of 3-inch plank, at $18 per M	1,170 00
16,320 pounds of bolt iron, as above, at 4 cents per pound	652 80
2,110 pounds of spikes 6″ long and $\frac{3}{8}$″ by $\frac{3}{8}$″ square, at $7\frac{1}{2}$ cents per pound	158 25
120 cords of ballast stone, at $9 per cord	1,080 00
For tearing down and removing decayed and defective timber	975 00
Carpentry, labor, &c., in rebuilding, superintendence, &c.	2,875 00
Sum	10,059 85
Add ten per cent. for contingencies	1,005 98
Amount required for repairs of the south pier	11,065 83

Recapitulation.

1 .Estimated cost of repairing the north pier	$17,564 58
2 .Estimated cost of repairing the south pier	11,065 83
Amount required for the repair of the piers at the natural outlet of Milwaukie river	28,630 41

J. D. GRAHAM,
Brevet Lieut. Col., Sup. Engineer.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, September 30, 1857.

B 4.

Estimate of the cost of dredging the bar at natural mouth of Milwaukie river, and within the river between the United States piers.

This will require the excavation and removal from the bar at the mouth of the river, in Lake Michigan, 32,775 cubic yards of sand, to be warped a distance of 2,500 feet and dropped to leeward in the lake.

Also, 15,895 cubic yards to be excavated and removed from the river and warped an average distance of 3,350 feet, and dropped in the same manner.

Then, 32,775 cubic yards of dredging, at 20 cents per cubic yard	$6,555 00
15,895 cubic yards, at 23 cents per cubic yard	3,655 85
For repairs of the United States steam dredge and 4 drop-bottom scows	1,500 00
Amount required for dredging	11,710 85

J. D. GRAHAM,
Maj. Top. Eng., Bvt. Lieut. Col., Sup. Eng.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, September 30, 1857.

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6. SHEBOYGAN HARBOR, WISCONSIN.

I beg leave to refer, in explanation of this harbor, to map G, No. 45, on a scale of two hundred feet to 1 inch, or $\frac{1}{2400}$, projected from a survey of the harbor, made under the direction of this office, in August, 1856. It has been transmitted, in duplicate, to the Topographical Bureau.

To put this harbor in proper condition, and to complete it will require the amount contained in my estimate, which accompanied my annual report (No. 116) for the year 1855.

The estimate, together with statements showing the amount of tonnage and the extent of the commerce of this port for that year, will be found in Senate (Ex.) Document No. 16, of the 34th Congress, 3d session, at pp. 282 to 288.

The estimate, given in detail, for completing the harbor (pp. 282 and 283 of that document) amounts to $36,614 55. I offer it as my estimate for this year.

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7. MANITOWOC HARBOR, WISCONSIN.

The appropiations for this harbor were exhausted by the work done in the year 1854, under the direction of this office, and in making a survey of the harbor in August, 1856.

The accompanying map, marked G, No. 46, on a scale of $\frac{1}{2400}$, or 200 feet to one inch, rendered to the Topographical Bureau in duplicate, is projected from that survey. It shows the proposed extension of the piers for completing this harbor.

To a full understanding of the importance of constructing these piers, the tonnage and extent of commerce of this port, and the esti-

mated cost of completing the harbor, I beg leave to refer to my reports for the years 1855 and 1856. They are printed in Senate (Executive) Document No. 16, of the 34th Congress, 3d session, from page 288 to 300, inclusive, and at pages 343 and 344.

The estimates for completing this harbor, which I now renew, will be found at pp. 296 to 298, in minute detail.

The amounts required are as follows, viz:

1. For the extension of the harbor piers	$59,869 92
2. For dredging	2,678 50
3. For meteorological instruments	232 52
Amount required to complete the Manitowoc harbor, Wisconsin	62,780 94

8. MICHIGAN CITY BREAKWATER, INDIANA.

No work has been carried on for this breakwater, for want of an appropriation, since my last annual report.

I beg leave to refer you to that report for the views then expressed in relation to the national importance of such a work on Lake Michigan, the amount and value of the commerce and navigation interested in it, and its estimated cost.

The report is contained in the printed Senate (Executive) Document No. 16, of the 34th Congress, 3d session, from pages 344 to 374.

The estimate of the cost of this work will be found at pages 352 to 353, amounting to $384,376 50. That sum is again presented as necessary for the construction of this breakwater on the original plan of the Board of Engineers.

9. NEW BUFFALO HARBOR, MICHIGAN.

For full information in regard to the condition of this work, I beg leave to refer to my annual report of last year. It will be found printed in Senate (Executive) Doc. No. 16, of the 34th Congress, 3d session, at pages 375 to 378. The small balance of the former appropriation then on hand has since been expended, as was therein stated it would be, in making a new survey which became absolutely necessary as the basis of a reliable estimate of the cost of constructing a harbor here.

The result of this new survey is shown on the accompanying map, marked G, No. 54, projected on a scale of $\frac{1}{2400}$, or 200 feet to one inch. The survey was completed the 30th of September, 1857.

The map shows the serpentine course of Galien river through the soft marshy soil of an old inland lake bed, for a mile before it enters Lake Michigan from an east northeast direction. This lake bed has an average width for that distance of about one-third ($\frac{1}{3}$) of a mile. It consists of soft mud and is covered with a growth of the marsh grass usual to this climate. It has still a depth of from 3 to 5 feet of water resting upon this soft muddy bottom, all over the surface embraced in the map.

The depth of water in Galien river is generally ten feet or more, and agrees closely with that represented on the map of Lieutenant John M. Berrien, of the United States army, projected from a survey made by him, assisted by Lieutenant E. Rose, United States army, in the year 1835.*

The place of the outlet of this stream into Lake Michigan is now, however, full fourteen hundred (1,400) feet to the southwest of what it was then. It was then nearly on the prolongation of Smith street, of the town of New Buffalo. It is now on the prolongation of Lemmon street, as will be seen by a comparison of Lieutenant Berrien's map with our own.

No soundings are given in the old or interior lake on Berrien's map. The surface of Lake Michigan may, however, have been then so much lower than now as not to have shown any.

The course of the shore of Lake Michigan is here northeast and southwest. It is separated from this interior lake bed by a narrow strip of sandy land of an average width of about four hundred and fifty (450) feet.

In order to ascertain accurately the mass and strength of this natural barrier between the waves of Lake Michigan and this old lake bed or basin, contour lines were traced with a level at every three (3) feet of perpendicular elevation, all over its surface, for a mile and a half ($1\frac{1}{2}$ mile) parallel with the shore of Lake Michigan.

A reference to the map (G, No. 54) will show its topography thus minutely obtained.

Its surface is very irregular, presenting hills which rise in peaks to heights of fifteen, twenty, thirty, forty, and fifty feet above the level of the surface of the lake. The peak, situated 148 feet to the southeast from the light-house, is ninety-three (93) feet above the level of the lake surface. The base of the light-house is forty-seven (47) feet above the same level.

It will be seen that the map is based upon an accurate triangulation spread over the whole surface embraced, both by land and water. The soundings are carried out to a depth of twenty-one to twenty-three (21 to 23) feet, covering the whole extent of the lake shore included in the map.

The position of the proposed piers to form a harbor is shown upon the map in dotted lines. It is at a favorable place for making a thorough cut across the sand barrier to communicate with the old Lake Pottawatome,† which may, at a very small expense in dredging, be easily converted into a roadstead of sufficient area and depth to accommodate any amount of shipping that would ever require a safe shelter here.

The plan presented by the Board of Engineers for this harbor‡ was confined to a commencement of the work, reserving its final opinion

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*This map, and the report of Lieutenant Berrien, will be found in Doc. No. 251 of the House of Representatives, of the 25th Congress, 2d session.

† This, we find, is the name on the United States land surveys.

‡ See pages 213 and 214 of part 3 of Senate (Executive) Doc. No. 1, of the 33d Congress, 1st session, containing the reports from the heads of departments and bureaus, which accompanied the President's message to Congress of December, 1853.

for consideration. It admitted that the piers should extend out to ten feet water, and should be 700 feet long each, and 300 feet apart. By our map ten feet water will be reached by piers 600 feet long.

A plan thus limited would, perhaps, accommodate the local commerce of this place, and the smaller class of vessels engaged in the lake commerce generally might find a refuge from storms in such a harbor here. Under this limited view, as a preliminary step, I herewith present an estimate, marked C 1, amounting to $98,113 47.

It will be seen by an inspection of a map of Lake Michigan that this position is much sheltered, by the east shore of the lake, from the direct force of easterly and northeasterly winds. At the same time a good harbor here would be accessible to vessels navigating the lake, in northeast, north, or northwest winds. This would give it great value as a place of refuge in the worst winds which prevail on this lake. To subserve such a purpose, however, for the general commerce of the lakes, it would be necessary to give it a greater capacity than is contemplated in the estimate marked C 1.

I therefore present another estimate, marked C 2, of the cost of constructing here such a harbor as would accommodate the largest class of vessels navigating the lakes, and serve them as a safe and accessible port of refuge in heavy gales of wind. The plan contemplated in this estimate is to project the piers far enough out to reach 16 feet of water in the lake, the width between them being 300 feet, and to make the thorough cut to communicate from Lake Michigan to the interior lake deep enough to carry thirteen (13) feet through by 300 feet wide. An inspection of the map will show that the length of this cut, through the land strip, will be four hundred and sixty (460) feet long.

The next feature in the plan is to dredge out a basin in the inland lake bed two thousand four hundred and fifty (2,450) feet long by seven hundred (700) feet wide and thirteen (13) feet deep, to be bounded by the dotted lines E F, F G, G H, H E, with a water passage at X, as drawn upon the map. The area of such a basin would be 190,555 square yards, or thirty-nine and one-third (39$\frac{1}{3}$) acres. It covers the town front between Smith street and Norton avenue, inclusive. It would serve as a safe roadstead for the commercial marine of the lakes, and for our armed ships in time of war. For the latter object it would only be necessary to increase the depth of water between the piers, in the thorough cut, and in the basin to 20 feet, which the plan admits of by additional dredging alone, which could be done in a few weeks.

The cost of the work under this more liberal and far more useful plan would be, as shown in estimate C 2, $167,607 79.

The necessity of a capacious and accessible port of refuge to the leward of the prevalent and most violent storms on Lake Michigan is evident. It is also evident that an armed fleet could not be maintained on this lake, in time of war, without such a port of refuge easily reached in those storms.

The value of the commerce and tonnage actually afloat on Lake Michigan during the season of navigation in the year 1855, requiring a safe and accessible harbor of refuge to leward of these violent storms, was shown in my annual report for last year to have been $218,297,348 78;

that is to say, two hundred and eighteen millions two hundred and ninety-seven thousand three hundred and forty-eight dollars and seventy-eight cents.* This important fact was presented while treating of the proposed breakwater at Michigan city, Indiana.

The erection of a national work somewhere on this part of the coast of Lake Michigan, of a capacity suitable for these great purposes, is certainly a desideratum calling for the earnest attention of the government.

In order to dispose effectually of all rival claims to preference for the actual position of such a work, I would recommend that a special board of engineers be appointed by the government to make the best selection, regardless of all except the public interests involved, and to report accordingly to the proper department. Such a work, to be efficient, must be more permanent and more costly than the harbor improvements generally on the lake coasts.

C 1.

Estimate of the cost of constructing a harbor at New Buffalo, Michigan, of a capacity to suit the present local trade of the place, and the smaller class of vessels navigating Lake Michigan.

1. The harbor piers.

These will be required to project 600 feet from the shore into the lake; each pier will therefore require 20 cribs, or 40 cribs for both piers, each 30 feet long, 25 feet wide, and 15 feet high from bottom to top, and 10 feet high from bottom to the surface of the water, to be constructed according to the drawings in sheet G, No. 21, in the Topographical Bureau, and the table marked T 3, at pages 18 to 21 of Senate Executive Doc. No. 16, of the 34th Congress, 3d session.

The cost of each crib will be as follows:

For 1,813½ lineal feet of pine timber, hewn or sawed, 1 foot square, at 18 cents per lineal foot.....	$326 43
For 927½ lineal feet of white oak timber, hewn or sawed, 1 square foot, at 22 cents per lineal foot.....	204 05
For 1,728 feet, board measure, of white oak plank, in pieces 24 feet long by 8 inches wide, and 3 inches thick, at $20 per M.....	34 56
For 4,196⅓ lbs. of wrought iron, round in form, and 1½ inch in diameter, for bolts, at 4 cents per lb.....	167 85
For 126.8 lbs. of wrought iron spikes ⅜ by ⅜ of an inch square, and 6 inches long, headed and pointed, at 7½ cents per lb.....	9 51

* See Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session, pages 349 and 350.

For 55 cords of hard boulder stone, for crib ballast, at $10 per cord	$550 00
Cost of materials for one crib	1,292 40
For carpentry, labor, hauling, and superintendence	350 00
Sum	1,642 40
Add 10 per cent. for contingencies	164 24
Estimated cost of each crib	1,806 64
Then 40 cribs, at $1,806 64 each, will cost for the two piers	72,265 60

2. For the dredging to obtain 10 feet depth of water between the piers.

This will require the excavation and removal of the following quantity of sand, viz:

38,666 cubic yards, at 14 cents per cubic yard..... $5,413 24

3. For the thorough cut between Lake Michigan and Pottawatomie lake.—(See Map G, No. 54.)

This cut will be 460 feet long, by 302 feet wide at the water surface. The greatest elevation of the cut is 12 feet above the water level. The average elevation is, however, only 4.8 feet. It is proposed to give the sides of this cut a slope of 2 base to 1 perpendicular. At this slope the soil will stand, if sown with grass seed, and thus covered with grass.

The number of cubic yards to be removed from this portion of the cut will be as follows, viz:

25,491 cubic yards of sand, at 15 cents per cubic yard...	$3,823 65
Then, for a cut with perpendicular sides, 302 feet wide and 10 feet deep, and 460 feet long, will require as follows, viz: 51,451 cubic yards of sand to be removed by dredging, at 6 cents per cubic yard, as it will be purchased for filling on the fronts of water lots at a price which will leave 6 cents per cubic yard as the net cost of dredging	3,087 06
Estimated cost of the excavation for the thorough cut to a depth of 10 feet below the level of the lake surface...	6,910 71

4. For protecting the sides of the thorough cut from abrasion.

This will require an oak pile, one foot square and 27 feet long, to be driven at every 10 feet apart, to which oak caps and stringers are to be bolted, and then the spaces filled by driving sheath piles 27 feet long by 8 to 10 inches wide, and 4 inches thick, to be bolted to the caps and stringers; these piles to be driven 10 feet into the soil.

Then, for both sides of the cut, there will be required as follows, viz:

For 92 white oak piles, each 27 feet long and 1 foot square = 2,484 cubic feet of white oak, at 25 cents per cubic foot	$621 00
For driving 92 white oak piles, at $2 50 each.....	230 00
For 920 lineal feet of white oak caps 1 foot square, at 22 cents per lineal foot.....	202 40
For 920 lineal feet of white oak stringers, to be placed 2 feet above the water line, at 22 cents.....	202 40
For 368 wrought iron bolts, each 20 inches long of $1\frac{1}{2}$ inch diameter round wrought iron = 613 lineal feet, weighing 5.972 lbs. per foot = 3,661 lbs., at 4 cents per lb.....	146 44
For 89,424 feet, board measure, of white oak sheath piling in pieces 27 feet long and 4 inches thick, at $25 per M..	2,235 60
For driving 828 sheath piles, at $1 each.....	828 00
For 3,312 wrought iron spikes for fastening the sheath piles to the caps and stringers, each 9 inches long and $\frac{3}{4}$ by $\frac{3}{4}$ of an inch square, weighing 1.493 lb. per lineal foot, or 1.12 lb. per spike = 3,709 lbs. at 6 cents per lb.	222 54
4. Estimated cost of protecting the sides of the channel through the thorough cut.....	4,688 38

5. FOR DREDGING A BASIN IN POTTAWATOMIE LAKE.

For a harbor on the scale above described, a basin 1,420 feet long, by 700 feet wide, limited by the dotted lines AB, BC, CD, DA, drawn upon map G, No. 54, if dredged to a depth 12 feet below the present lake surface, would suffice. The area of such a basin would be 110,444 square yards, or 22.8 acres.

The average depth of water now existing here is four feet, but the lake is now about $3\frac{1}{2}$ feet higher than its low water stage.

The depth of excavation in the soil would then be eight feet, and the quantity of soil to be removed 294,518 cubic yards.

It is stated in the report of Mr. Berrien, before alluded to, that this soil is so soft that it can he removed by a dredging machine, at a cost of three (3) cents per cubic yard.

Our own survey, made in September, 1857, corroborates this statement as correct.

5. Then 294,518 cubic yards, at 3 cents per yard, is $8,835 54.

The owners of lots fronting on this basin would erect lines of sheath piling on its borders at their own expense, within which they would be glad to receive the excavated stuff for filling up to required grades, and thus it would be secured against being carried back into the basin.

Recapitulation of items in estimate C 1.

1. For two parallel piers 600 feet long, each, and 300 feet apart	$72,265 60
2. For dredging between these piers to obtain a depth of ten feet of water	5,413 24
3. For excavation to form the thorough cut	6,910 71
4. For piling to protect the sides of the thorough cut from abrasion	4,688 38
5. For dredging a basin in Pottawatomie lake, 1,420 feet long by 700 feet wide, to produce 12 feet depth of water	8,835 54
Amount of estimate C 1	98,113 47

J. D. GRAHAM,
Major Top. Eng. Corps, Brevet Lieut. Col.,
Superintending Engineer.

OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

C 2.

Estimate of the cost of constructing a harbor at New Buffalo, Michigan, suitable for the accommodation, as a harbor of refuge, of the largest class of mercantile vessels navigating Lake Michigan.

For such a harbor the piers should reach to a depth of sixteen (16) feet of water in Lake Michigan, and the west pier would, in that case, be eight hundred and ten (810) feet long, and the east pier would be seven hundred and fifty (750) feet long, and their interior faces would be three hundred feet apart. It is proposed to construct these piers in accordance with the drawings in sheet G, No. 21, and the specifications in table T 3, contained in my report No. 116, of December 31, 1856, to be found at pages 18 to 21 of Senate Doc. No. 16, of the 34th Congress, 3d session, the depth of water between the piers to be thirteen feet.

The thorough cut, to communicate with Pottawatomie lake, will be the same as in estimate C 1, except that the depth of its water prism should be thirteen feet instead of ten feet.

The interior basin in Pottawatomie lake should be 2,450 feet long, by 700 feet wide, corresponding to the figure E F G H, drawn in dotted lines on the map G, No. 54, and it should be thirteen feet deep. The estimate of these several items will then be as follows, viz:

1.—*The harbor piers.*

These will require 27 cribs for the west pier and 25 for the east pier, or 52 cribs for both piers, each 30 feet long, 25 feet wide, and of an average depth from top to bottom of 18 feet, or 13 feet from the water line to the soil at bottom.

The cost of one crib will be as follows, viz:

For 3,236 lineal feet of white oak timber hewn one foot square, at 22 cents per lineal foot	$711 92
For 1,728 feet, board measure, of white oak plank, three inches thick, for flooring, at $20 per thousand	34 56
For 5,074 lbs. of round wrought iron for bolts, 1½ inch in diameter, at 4 cents per lb	202 96
For 127 lbs. of wrought iron spikes, ⅜ by ⅜ of an inch square, pointed and headed, at 7½ cents per pound	9 52
For 67⅕ cords of hard boulder stone for crib ballast, at $10 per cord	672 00
Estimated cost of materials for one crib	1,630 96
For carpentry, labor, superintendence, &c	500 00
Add ten per cent. on the above for contingencies	213 09
Estimated cost of one crib	2,344 05

(1.) Then 52 cribs, at $2,344 05 each, equals for the cost of the two piers $121,890 50

2. FOR THE DREDGING TO OBTAIN THIRTEEN FEET DEPTH OF WATER BETWEEN THE PIERS.

This will require the excavation and removal of the following quantity of sand, viz:

(2.) 60,141 cubic yards, at 14 cents per cubic yard $8,419 74

3. FOR THE THOROUGH CUT BETWEEN LAKE MICHIGAN AND POTTAWATOMIE LAKE.—(*See Map G, No.* 54.)

The first item under this head will be the same as it is under the third head in estimate C 1, namely, cutting to the depth necessary to reach the level of the water surface:

25,491 cubic yards of sand, at 15 cents per cubic yard	$3,823 65
Then for a channel with perpendicular sides, 302 feet wide, 460 feet long, and 13 feet deep, there will be required to be excavated 66,887 cubic yards, at six cents per cubic yard	4,013 22
(3.) Estimated cost of a thorough cut, with a water prism 13 feet deep	7,836 87

4. FOR PROTECTING THE SIDES OF THE CHANNEL IN THE THOROUGH CUT FROM ABRASION.

This will be the same as the item under the fourth head of the estimate marked C 1, viz	$4,688 38

5. FOR DREDGING A BASIN IN POTTAWATOMIE LAKE.

This basin should be of sufficient capacity to accommodate as a harbor of refuge, the general mercantile marine of Lake Michigan, and also our national armed ships in time of war. The depth for the mercantile marine need not be greater than thirteen feet, and our estimate is, therefore, based on that depth. It may easily, and in a few weeks, be increased to twenty feet of depth to accommodate ships of war. The depth between the piers would, in such an event, have to be similarly increased by dredging. The dredging would be done by the steam-dredge belonging to Lake Michigan.

Then, an excavation of 2,450 feet long by 700 wide, and 13 feet deep, will require the removal by the dredging machine of the following quantity of this soft mud, viz: 825,740 cubic yards, at 3 cents per per cubic yard, $24,772 20.

Recapitulation of items in estimate C 2.

1. For two parallel piers, the west being 810 feet long, and the east 750 feet long, each 25 feet wide, and 300 feet apart	$121,890 60
2. For dredging to produce a depth of 13 feet of water between these piers	8,419 74
3. For the excavation to form the thorough cut with a water prism 13 feet deep	7,836 87
4. For protecting, by close-piling the sides of the channel in the thorough cut against abrasion	4,688 38
5. For dredging a basin in Pottawatomie lake, 2,450 feet long by 700 feet wide, and 13 feet deep	24,772 20
Amount of estimate C 2	167,607 79

J. D. GRAHAM,
Major Topographical Engineer Corps,
Brevet Lieutenant Colonel, Superintending Engineer.
OFFICE GEN. SUP. LAKE HARBOR WORKS,
Chicago, September 30, 1857.

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10. ST. JOSEPH'S HARBOR, MICHIGAN.

For a description of this harbor, its importance to the commerce of the lakes, and the condition of the piers on the 15th of November, 1856, I beg leave to refer to my annual report of that date, which is printed at pp. 379 to 385, in Senate (Executive) Doc. No. 16, of the 34th Congress, 3d session. I would also refer, for explanation, to map G, No. 47, projected on a scale of $\frac{1}{2400}$, or 200 feet to 1 inch from a survey of this harbor, made under the direction of this office in August, 1856.

In that report the dilapidated condition of the piers, and the necessity for a renewal of a great portion of them was fully described. No appropriation having been made, however, for this purpose, the work

of decay has been going rapidly on, and the piers are now in a much worse condition than at that time.

There is now a thorough breach in the south pier from its angle opposite to the end of Morrison's pile wharf, for a distance of one hundred and forty (140) feet lakeward from that angle. Through this breach the lake sea now sweeps, and all communication with the harbor beacon light, along that pier, is now cut off. This is a serious disaster to navigators, because it not only deprives them of the benefit of this light, but the lake waves which are driven in by westerly winds force in the sand, and the depth of water in the channel is thus becoming seriously diminished.

I recommend that as little time as possible be lost in renewing the south pier in the manner described in my annual report of last year.

The breach in the north pier has also been much increased since the date of my annual report for 1856. Beginning at a point thirty-five (35) feet eastward of the lake shore, the breach extends thence a distance of three hundred and twenty-four (324) feet southeasterly along the line of that pier.

Through this wide gap the sea flows unchecked in strong westerly winds, making a clear sweep across the harbor channel, and if not soon checked, it will wash a passage through to the lake shore on the northeast side of this pier, and thus make an island, cutting off all communication between the harbor and the northwest or sound portion of the north pier.

The portion of this pier which extends three hundred and seventy-six (376) feet southeast of this great gap is now in a more rotten condition than was reported last year. I have, therefore, to renew the recommendation then made, that seven hundred (700) feet of this north pier be rebuilt anew.

The new pier work required for this harbor is, therefore, as follows, viz:

For the north pier	700 feet.
For the south pier	670 feet.
Total length of new pier work required	1,370 feet.

An estimate, in detail, of the cost of this was given in my last year's report, (see pp. 381 and 382 of the above mentioned printed Senate document,) amounting to $87,202 21

To which I now add, as follows:

For tearing away 586 feet, lineal, of old pier work, and removing the materials, at $12 per foot	7,032 00
For dredging 12,870 cubic yards of sand from the channel, at 16 cents per cubic yard	2,059 20
For dredging 5,540 cubic yards of sand near the end of the north pier, at 20 cents per cubic yard	1,108 00
For meteorological instruments	232 50
Amount of appropriation required to complete St. Joseph's harbor, Michigan	97,633 91

While the estimate for dredging is $2,059 20 greater than it was last year, owing to the quantity of sand which has been washed into the harbor through the increased breaches in the piers, that for tearing away and removing portions of the old rotten pier work, is $13,968 less, owing to the large portion of it which, since last year, has been entirely swept away by the action of the sea.

I beg leave to repeat here the conclusion of my report of last year in regard to the importance of keeping up this harbor, viz:

"The harbor of St. Joseph is, from its position on the lake coast, one of the easiest for vessels, caught in northerly or northeasterly gales, to enter, from either the eastern or western coast of Lake Michigan.

"Its works ought not to be allowed to go to decay, for the whole commerce, as well as the farmers of the counties in Michigan and Indiana, before enumerated, are deeply interested in its preservation."

I present, herewith, an additional map, marked G, 55, of a portion of St. Joseph's harbor, showing the portions of the piers which are destroyed or injured by the action of the sea, owing to their rotten condition.

11. BLACK LAKE HARBOR, MICHIGAN.

In explanation of the nature of the improvement proposed for this harbor, I beg leave to refer to the accompanying map, G, No. 48, which has been transmitted in duplicate to the Topographical Bureau. It is drawn on a scale of $\frac{1}{2400}$, or 200 feet to one inch, from survey made under the direction of this office in September, 1856. The topography is shown in minute detail, aided by contour lines obtained with the levelling instrument, and drawn at every five (5) feet of perpendicular elevation. The soundings in Lake Michigan are carried out to a depth of twenty (20) feet.

Black lake is laid down for nearly half a mile above the commencement of the narrow and crooked channel through which its waters reach Lake Michigan. This narrow channel is also laid down, and the soundings, throughout both, are minutely given in feet and decimals.

The original design for a harbor at this place was presented by Agent John R. Bowes, in the year 1849. It consisted of a proposed thorough cut 1,090 feet long, such as to give a channel 10 feet deep and 275 feet wide throughout that length, by which the waters of Black lake were to be discharged into Lake Michigan.

This cut was to be followed at its western extremity by two parallel piers, 275 feet apart, and of a sufficient length to reach a depth of twenty (20) feet of water in Lake Michigan.

Mr. Bowes' report and map will be found printed in Senate (Executive) Doc., No. 20, of the 31st Congress, 1st session. By measurement, according to the scale of that map, as printed, the direction of the thorough cut (C D on his map) was proposed to be S. 74° W. (magnetic in the year 1849;) and the direction and length of the piers proposed by him were to be N. 86° 15′ W. (magnetic in 1849,) and 1,283 feet long, each.

His estimate of the cost of the work was $105,225 78.—(See pp. 167

and 168 of part 3 of documents accompanying the President's message to Congress of December, 1853.)

This general plan was approved by the board of engineers on the 9th of May, 1853. The board afterwards, however, apparently with the view of diminishing the expense of construction, modified the plan so as to limit the length of the piers to what was necessary to carry them out to ten (10) feet water in Lake Michigan; that is to say, to a depth equal to that proposed for the channel in the thorough cut.—(See pp. 211 and 212 of the same volume and document.) This would, according to Mr. Bowes' map, limit the length of the piers to 670 feet each.

The only appropriation ever made for this work was for eight thousand (8,000) dollars, granted in 1852. It was inadequate even to an advantageous beginning. It was all expended in an attempt to build out into Lake Michigan a line of pile wharfing, which was designed to cover and protect the construction of the solid work for the south pier, whenever Congress should grant the additional sum necessary for this principal and more costly structure.

Had the expected additional appropriations been granted at the next session of Congress, there is no doubt that the solid structure could have been made to follow up the temporary pile wharfing as the latter progressed, and the expenses which were actually incurred have been made useful. But such was not the case. The preliminary work was so long left to bear the brunt of the heavy lake sea on this exposed part of the coast, that, by the action of the storms of three winters, a large portion of the work which had been done has been destroyed. For an account of this I would refer to my general report, No. 73, of the 29th of April, 1855, to be found at pages 426 and 427 of part 2 of the Senate document, No. 1, (Ex.) of the 34th Congress, 1st session.

According to map G, No. 48, the direction of this thorough cut will be S. 74° 13′ W. compared with the true meridian, and it will be 998½ feet long, measured on the axis of the cutting.

According to the same map, the direction of the piers will be N. 79° 26′ W., and to reach to 10 feet of water in Lake Michigan they must be 650 feet long each. To reach to 12 feet they must be, each, 672 feet long, which would require for each pier 21 cribs, or for both piers 42 cribs, each 32 feet long, 20 wide, and of an average height of 12 feet from the bottom to the water surface, or 17 feet from the bottom to the flooring at top. The width of channel between the piers is supposed to be continued at 275 feet.

In regard to the channel through the thorough cut, I would recommend that its width be reduced from 275 to 250 feet, for the following reasons:

The greater width between the piers adds much to the facility offered to vessels for entering the harbor and reaching a safe anchorage. For this reason it is suggested that the width of 275 feet be, in this respect, adhered to. But when once vessels have got safely in between the piers, a width of 250 feet in the canal will be quite sufficient to enable any crowd of them to proceed with ease into Black lake. The excavation, supposing we have a depth of 12 feet in the channel, will be 226,845 cubic yards for a width of 250 feet; and 248,487 cubic

yards for a width of 275 feet. The difference is 21,642 cubic yards, which, at 16 cents per cubic yard, will amount to a saving of $3,462 72.

The slopes for the side, assumed in the computation, is 3 base to 2 perpendicular. A reference to the contour lines on our map will show that the steep sides of the highest and most abrupt hills have about that proportion of elevation to base, and thence we infer it to be proper for the sides of the cut, which must be cultivated in grass.

The sides of the canal will require to be defended from abrasion by close-piling, similar to that which is provided for in item four of the estimate, marked C 1, for New Buffalo harbor, which amounts, in cost, to five dollars and ninety-six cents ($5 96) per lineal foot.

In the case of Black lake harbor there will be 2,250 feet (two and thousand two hundred fifty feet) of this close-piling to defend both sides of the cut as represented on map G, No. 48, and to reach to twelve (12) feet water in Black lake.

Being deprived, in the case before us, of a stream or inlet in which to build the cribs and then float them to their proper positions for the pier alignment, the mode adopted by Agent Bowes, of first constructing a pile wharf of greater width than the intended piers within which to build the cribs, appears judicious and even indispensable. In reference to this point I beg leave here to quote from my general report, No. 73, of April 29, 1855, as follows:

"The bridge pier is intended as a mere auxiliary in constructing the permanent work, and as a depository of materials while the pier work shall be carried on. It seems to be a very judicious mode of proceeding at an exposed position like this, where the force of the waves of the open lake have to be encountered unless some such defence against them be provided.

"It appears to me, however, that it would be better that the lines of both the intended permanent piers should be thus simultaneously occupied, and that on reaching a depth of five or six feet of water, sufficient to float small vessels loaded with material, both the bridge work and the permanent work should go on and progress *pari passu*, until a channel between the permanent piers be formed of sufficient length and depth, of itself, to protect the further building of the permanent cribs. After thus attaining a certain length of channel it would be quite practicable to defend the building up of additional cribs within this channel against the action of the lake waves, by temporarily aligning a certain number of the cribs transversely of the channel way, to be pushed further and further out as the work progresses. This would not leave the weaker work (the bridge pier) liable to be destroyed by the great power of the lake waves in a storm before reaping the advantage for which they were designed."

I herewith present an estimate, marked D, of the cost of a harbor thus constructed, the piers to reach to twelve feet water in Lake Michigan, and the close-piling to reach to the same depth in Black lake, with a depth of channel throughout of twelve (12) feet.

This estimate, D, amounts to the sum of $128,343 02.

Our map G, No. 48, and Mr. Bowes' map, of 1849, both show Black lake to be one of the deepest and most capacious inland roadsteads to be found on the whole coast of Lake Michigan.

At present there is but little trade from the country immediately around and back of this lake, for the reason, chiefly, that it is but sparsely settled; and its resources, therefore, are not developed. Besides this, the stream which forms its outlet into Lake Michigan is too shallow to admit the passage of any but the smallest class of vessels through it.

If there were a harbor work affording a good water communication between the two lakes, Black lake would be one of the best roadsteads on the great western lake border, and would be highly valuable to our navy in time of war.

I would recommend that the amount in the estimate be granted in three equal annual appropriations, each, of $42,781.

D.

Estimatc of the cost of constructing a harbor at Black Lake, Michigan, at the position represented on map G, No. 48.

1. FOR THE PIERS.

These will require to be each 672 feet long, and will require, each, 21 cribs, or for both piers 42 cribs, each 32 feet long, 20 feet wide, and of an average height of 12 feet from bottom to the water surface, or 17 feet from the bottom to the flooring at top, to be constructed according to the drawings in sheet G, No. 20, or case 2 of crib work, and the specifications in table T 2, to be found at pp. 16 to 18, of Senate (Ex.) Doc., No. 16, of the 34th Congress, third session.

One such crib will cost as follows:

For 1,961 lineal feet of pine timber, hewn one foot square, at 16 cents per foot	$313 76
For 880 lineal feet of white oak timber, hewn one foot square, at 18 cents per foot	158 40
For 1,482 feet, board measure, of white oak plank, for flooring, 3 inches thick and 8 inches wide, at $16 per M	23 71
For 2,660 lbs. of 1-inch square wrought iron for bolts, at 4 cents per pound	106 40
For 137 lbs. of wrought iron spikes, $\frac{3}{8}$ by $\frac{3}{8}$ of an inch square, at $7\frac{1}{2}$ cents per pound	10 28
For 53 cords of hard boulder stone, at $10 per cord	530 00
For labor, carpentry, superintendence, &c	400 00
Sum	1,542 55
Add 10 per cent. for contingencies	154 25
Estimated cost of one crib	1,696 80

1. Then 42 cribs, at $1,696 80 each, gives for the cost of the two harbor piers $71,265 60.

2. DREDGING TO OBTAIN TWELVE FEET DEPTH OF WATER BETWEEN THE PIERS, AND IN BLACK LAKE.

This will require the excavation and removal of the following quantity of sand, viz:

From the shore of Lake Michigan to the curve of 12 feet depth in the same, will require the excavation and removal of 69,444 cubic yards, at 14 cents per cubic yard	$9,722 16
For 9,518½ cubic yards to be excavated between the shore of Black lake and the 12-feet curve in the same, at 9 cents per cubic yard	856 66
2. Total for dredging	10,578 82

3. FOR THE THOROUGH CUT BETWEEN BLACK LAKE AND LAKE MICHIGAN.

This cut to be 998½ feet long and 250 feet wide, by an average depth, from the surface of the ground to the water level, of 11½ feet. The side slopes to be three of base to two of perpendicular.

This will require, from the surface of the ground down to the water level, as follows, viz:

106,735 cubic yards, at 16 cents per cubic yard	$17,077 60
Then, for a cut, with perpendicular sides for the canal, 998½ feet long, 250 feet wide, and 12 feet deep, will require 120,110 cubic yards, at 10 cents per cubic yard	12,011 00
3. Total for excavating to form the thorough cut	29,088 60

4. FOR PROTECTING THE SIDES OF THE THOROUGH CUT FROM ABRASION.

This part of the work will be the same as that provided for in item 4 of the estimate marked C 1, for New Buffalo harbor, that is to say, $5 96 per lineal foot:

4. Then, 2,250 lineal feet (as is described in the text of this report) of close-piling, at $5 96 per lineal foot	$13,410 00

5. FOR 400 LINEAL FEET OF PILE WHARFING, 200 FEET FOR EACH PIER ALIGNMENT.

This part of the work is estimated at $10 per lineal foot:

Then 400 feet, at $10 per foot	$4,000 00

Recapitulation of items in estimate D.

1.	For the two piers	$71,265 60
2.	For dredging	10,578 82
3.	For the excavation to form the thorough cut	29,088 60
4.	For close piling to protect the sides of the thorough cut	13,410 00
5.	For pile wharfing to protect the building of the cribs in the early part of the work	4,000 00
	Amount required to complete Black lake harbor, Michigan	128,343 02

J. D. GRAHAM,
Maj. Top. Engineers, Bvt. Lt. Col., Sup'g Eng.

OFFICE GEN. SUP. OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

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12. GRAND RIVER HARBOR, MICHIGAN.

This harbor is situated at the mouth of Grand river, two-thirds of a mile below the thriving town of Grand Haven. It is intended for the accommodation of the trade of the extensive and fertile back country, bordering on Grand river, which must have an outlet here in order to reach a market.

Grand river is navigable for steamboats as high up as Grand Rapids, a distance of fifty (50) miles from its mouth, and for batteaux one hundred (100) miles. It is one of the best streams for the transportation of produce in the interior of the State of Michigan; it flows through the fertile counties of Ottowa, Kent, Ionia, and Clinton, whose agricultural and manufacturing products would always find a sure and ready market, if the egress and entrance at the mouth of the river were improved. It possesses one rare advantage, which would greatly aid an artificial débouche between parallel piers at its mouth, which is, that the force of the current during times of high water is strong enough to keep a channel so formed well scoured of sandy deposits. The freshet of the last spring fully demonstrated this.

Since the period of the original project for the improvement of this harbor, which was in the year 1849, its importance has greatly increased, in consequence of the great increase of agricultural production in the surrounding country, and the consequent extension of commercial business.

Grand Haven is one of the termini of the railroad from Detroit which, in connexion with a line of steam packets, forms the great

transportation line between Detroit, in Michigan, and Milwaukie, in Wisconsin. For information in regard to the commercial importance of this line, and the value of the proposed improvement here, in connexion with it, I beg to refer to my annual reports for the years 1855 and 1856, to be found printed in Senate (Executive) Document No. 16, of the 34th Congress, 3d session. from pages 207 to 209, 243 to 251, and 388 to 394.

For a full understanding of the character of the channel of Grand river, from its mouth to a point half a mile above the town of Grand Haven, I beg leave to refer to the accompanying map, G, No. 49, projected from an accurate trigonometrical survey, made under the direction of this office in October, 1856. It will there be seen that a depth of full twelve (12) feet of water is carried out for a distance of one thousand (1,000) feet lakeward from the mouth of the river. Beyond this distance, full ten (10) feet are carried into the lake, with the exception of a narrow sand spit or shoal two hundred and twenty-five (225) feet wide, upon which there are only nine (9) feet of water.

The great object in view is to deepen this outlet to full twelve (12) feet throughout, in order to give the requisite facilities for the commerce and navigation of this important port.

In considering this subject, reference has been made to the original project presented for this improvement by John R. Bowes, esq., United States civil agent, in the year 1849, as mentioned in a subsequent report from him to the Topographical Bureau, of September 19, 1853, to be found printed in Senate (Executive) Document No. 1, of the 33d Congress, 1st session, at pages 168 and 169, of part 3.

We have also had access to his map which accompanied that report, a copy of which is on file in this office.* It differs from our own in orientation three degrees and forty minutes (3° 40′) by a comparison of our true meridians as they are shown on the respective maps.

In regard to the direction of the streets of the town of Grand Haven, there is a still greater difference of ten degrees and thirty minutes, (10° 30′.) The direction of the streets, compared with the true meridian, are, by our survey and map, N. 23° 20′ E., intersected at right angles by the cross streets, whose direction is S. 66° 40′ E. On Mr. Bowes' map the streets are laid down with the directions, in comparison with the true meridian, obtained by applying the magnetic variation given by him in 1849, of 5° 22′ east of north, to his magnetic meridian of N. 33° 50′ E., and the cross streets S. 56° 10′ E. This discrepancy is to be regretted, because it deprives us of the means of making such comparisons as would otherwise show what changes have taken place between the two periods of these surveys, at points which are important in the discussions necessary for arriving at the best mode of improvement.

Mr. Bowes' suggestion of first defending the concave bend in the southern shore of the river below the town from the abrasion of the current which impinges against it, has already been approved by the board of engineers.—(See pages 210 and 211, of part 3 of Senate

* Mr. Bowes' report and map were, I understand, printed in Senate (Ex.) Doc. No. 20, of the 31st Congress, 1st session. I have not been able to obtain a copy of the report.

(Ex.) Doc. No. 1, of the 33d Congress, 1st session.) This was proposed to be done by strong sheath piling, and an estimate was given for 2,361 lineal feet of such piling, at a cost of $21,950.

From the best comparison we can make of the aspects at this point, as shown by the two maps, we infer that the concavity has increased on the versed sine of the curve at least eighty (80) feet in seven years.

This would seem to prove the necessity of the sheath piling as recommended. We estimate, however, that 1,600 feet in length along the shore of this piling will now suffice.—(See map G, No. 49.) The town docking will cover the remaining portion included in Mr. Bowes' estimate.

The next most important step to be taken, I would suggest, is to construct two parallel piers, four hundred (400) feet apart, and twenty (20) feet wide, to project out into the lake in prolongation of the direction of the river channel, just above its mouth, of such length as to reach the termination of the present 12 feet continuous curve from the river. This will require the south pier to be 1,312 feet long, and the north pier to be 1,216 feet long. The south pier will, in this case, be composed of 41 cribs, each 32 feet long, and the north pier of 38 cribs, each 32 feet long. Total, for both piers, seventy-nine (79) cribs, each 32 feet long, 20 feet wide, and 12 feet high, from the soil at bottom to the water level, or 17 feet high from the soil at bottom to the flooring at top, to be constructed according to the drawings in sheet G, No. 20, or case 2 of crib work, and the specifications given in table T 2, to be found at pages 16 to 18 of my annual report of 1855, as it is printed in Senate (Executive) Doc. No. 16, of the 34th Congress, 3d session.

It appears evident that by thus prolonging, artificially, the channel of the river, the force of its current would extend the scour to a depth of twelve (12) feet, as far beyond the artificial mouth as it now exists beyond the present natural mouth of the river. This would, we think, insure a depth of twelve feet throughout, until that depth were reached in Lake Michigan.

Since we were first required, in the year 1854, to give attention to the general character of the rivers emptying into Lake Michigan, we have entertained, decidedly, the opinion that habitual dredging must constitute an important part of any system that can be devised for keeping down the shoals or bars which an immutable law of nature is constantly tending to form, more or less, opposite to their outlets into the lake. This tendency will, of course, be the less in proportion as the force of the downward current of the river is greater than that of the littoral lake current which sweeps along parallel to its coast.

In all cases, however, partial dredging is necessary.

In the case before us, nature has furnished, in the force of the river current, an unusual auxiliary in keeping down the shoals opposite to its mouth. They should, however, be thoroughly cleared out, as one of the important steps in these improvements, and the cost of this operation is included in the estimate herewith presented.

As we have elsewhere before stated, there will be economy in providing a certain number of good dredging machines, to be constantly

employed on our lake coasts in keeping open the mouths of our principal commercial rivers, so as to insure an easy and safe communication with the lakes.

The curved line for the proposed close-piling, to defend the concave portion of the southern shore of the river below the town of Grand Haven, and the position of the proposed piers, to extend out from the mouth of the river, are projected in red dotted lines on map G, No. 49.

The estimated cost of these works, and of the necessary dredging off the western extremity of the proposed pier work, is herewith presented in the estimate marked E, amounting to the sum of $160,185 60.

The items are shown as follows, viz:

1. For close-piling	$18,360 56
2. For the two piers	134,047 20
3. For dredging	7,777 84
Total to complete the work as above	160,185 60

I would recommend that this sum be granted by three equal annual appropriations of $53,395 20 each.

The direction we have given to the piers on the map is S. 69° 40′ W., compared with the true meridian.

This direction seems evidently to be indicated by nature as the proper one, because it is that of the channel which has been scoured out by the force of the river current to a depth of 12 feet, for a distance of one thousand (1,000) feet into the lake beyond the mouth of the river.

The entrance here is protected by the east shore of Lake Michigan from the effects of easterly and northeasterly winds. The winds which operate with greatest effect here are those from the northwest and west, but especially the former, as they are more frequent and of greater force.

The only appropriation ever made for this harbor was of two thousand dollars,* ($2,000,) granted in 1852. It has been expended in making the survey and preparing the map marked G, No. 49, and in digesting plans for the improvement here submitted.

The topography of the land surface included in our map is represented by horizontal curves, or contour lines, obtained by aid of the levelling instrument and drawn at every five (5) feet of perpendicular elevation above the level of the surface of Lake Michigan, at the time of the survey, namely, in October, 1856.

It will be seen that the elevations above the level of the lake surface, at that date, of some of the principal points, are as follows, viz:

The base of the light-house	52.1	feet.
A point 450 feet S. 62° E. of light-house	115.4	"
A point 1,083 feet S. 74° 15′ E. of light-house	205.3	"
A point 420 feet N. 58° E. of light-house	129.1	"
A point 805 feet N. 60° 45′ E. of light-house	123.8	"

*This sum was erroneously printed $20,000 (twenty thousand dollars) at page 388, line 29 from top, of Senate (Executive) Doc. No. 16 of the 34th Congress, 3d session.

A point 1,170 feet N. 88° 30′ E. of light-house..... 118.8 feet.
A point 1,160 feet N. 72° 30′ E. of light-house..... 145.8 "
A point 1,655 feet N. 55° 30′ E. of light-house..... 126.3 "

These are all on the south side of the river.

The map will show the positions of other points on the north side of the river, 122.7, 139.3, 154.5, 215.2, and 118 feet above the level of the lake surface.

E.

Estimate of the cost of improving the Grand river harbor, at the mouth of Grand river, Michigan, according to the project shown on map G, No. 49.

1. FOR THE CLOSE-PILING ON THE LINE A B.

This is a curved line whose versed sine on the cord A B is 115 feet. The length of the arc is 1,600 feet. The versed sine of the arc of the shore, as it now exists, between the points A and B, is 320 feet.

The depth of water to be occupied by our arc of close-piling averages 16 feet. The greatest depth is 21 feet.

We propose that this close-piling shall consist of strong white oak piles, one foot square, placed in close contact one with another, to be driven eight feet into the soil at the bottom of the river, and to project six feet above the water level. This will require these piles to be of an average length of 30 feet; that they be connected at top by caps of white oak one foot square, and one foot above the water surface by white oak stringers on each side, one foot wide by six inches thick; that the caps be fastened to each pile-head by a wrought iron bolt one inch square and twenty inches long; that the stringers on each side of the piles be bolted to them by a bolt of one inch square wrought iron, two feet long, to be driven through at each alternate pile.

Then, that there be another row of similar oak piles driven twelve feet apart, and fourteen feet nearer to the shore, and parallel to the first line of piling; that they be connected one with another by caps and stringers, and similarly bolted at every pile. Then, that the two rows be tied together by cross-ties of white oak, one foot square and twenty feet long, connecting at the caps by dove-tailed notches and tenons, and bolts of wrought iron one inch square and eighteen inches long. Finally, that the intermediate space between this work and the shore be filled in with the earth which is being removed for grading in extending the streets of the town.

The cost we estimate as follows, viz:

For 52,020 lineal feet of white oak piles, hewn one foot square, and averaging 30 feet long, at 20 cents per lineal foot.....	$10,404 00
For 3,200 lineal feet of white oak caps, hewn one foot square, at 18 cents per lineal foot.....	576 00

For 6,400 lineal feet of white oak stringers, sawed one foot wide by six inches thick = 3,200 cubic feet of white oak, at 18 cents per cubic foot.....	$576 00
For driving 1,734 white oak piles, 1 foot square, eight feet into the soil, at $2 50 each.....	4,335 00
For 134 cross-ties to connect the two rows of piling, each 14 feet long, of white oak, hewn one foot square, = 1,876 lineal feet, at 18 cents per foot.....	337 68
For 4,975 feet lineal, of one inch square wrought iron for bolts, weighing 3.38 pounds per foot, = 16,815 pounds, at four cents per pound.....	592 60
For workmanship in notching the caps and tenoning the ends of the cross-ties, in bolting them to the stringers, &c.....	500 00
Sum.....	17,321 28
Add for contingencies six per cent.....	1,039 28
1. Amount required for the protection of the southern bank of the river at the line A B (map G, No. 49)....	18,360 56

2. FOR THE PIERS.

These will consist of 79 cribs, each 32 feet long, 20 feet wide, and 12 feet high, from the soil at bottom to the water level, or 17 feet high from the bottom to the flooring at top. It is proposed to construct them in accordance with the drawings in sheet G, No. 20, now in Topographical Bureau, and the specifications in table T 2, at pages 16 to 18 of Senate (Ex.) Doc. No. 16 of the 34th Congress, 3d session.

The cost of one such crib will be as follows, viz:

For 1,961 lineal feet pine timber, hewn one foot square, at 16 cents per foot.....	$313 76
For 880 lineal feet of white oak timber, hewn 1 foot square, at 18 cents per foot.....	158 40
For 1,482 feet, board measure, of white oak plank for flooring, 3 inches thick and 8 inches wide, at $16 per M.	23 71
For 2,660 pounds of 1 inch square wrought iron for bolts, at 4 cents per pound.....	106 40
For 137 pounds of wrought iron spikes, $\frac{3}{8}$ by $\frac{3}{8}$ of an inch square, pointed and headed, at $7\frac{1}{2}$ cents per pound	10 28
For 53 cords of hard boulder stone for crib ballast, at $10 per cord.....	530 00
For labor, carpentry, superintendence, &c.....	400 00
Sum.....	1,542 55
Add for contingencies ten per cent.....	154 25
Estimated cost of one crib.....	1,696 80

2. Then, 79 cribs, at $1,696 80 each, give, for the cost of the two piers, $134,047 20.

3. FOR THE DREDGING.

This is required to produce a channel twelve feet deep, and, say, five hundred (500) feet wide, in prolongation of the channel between the proposed piers, until that depth is reached in the lake.

When once dredged out it will require but little annual dredging in addition to the scour from the current of the river to keep it open.

We assume five hundred feet for the width of this dredging to afford the desired facilities to vessels in making the channel between the piers in rough weather.

This will require the excavation and removal of—

3.	55,556 cubic yards of sand, at 14 cents per cubic yard.....	$7,777 84

Recapitulation of items in estimate E.

1.	For protecting the southern shore of the river from abrasion, on the line A B.—(See map G, No. 49.)..	$18,360 56
2.	For constructing the piers at the mouth of the river	134,047 20
3.	For dredging.....	7,777 84
	Amount required to complete the harbor at the mouth of Grand river, Michigan.....	160,185 60

J. D. GRAHAM,
Major U. S. Top. Eng. Corps, Bvt. Lt. Col. Sup. Eng'r.
OFFICE GENERAL SUPERINTENDENCE
OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

OTHER HARBORS ON LAKE MICHIGAN.

Under the instructions hereto attached, marked F 1 and F 2, surveys were made, under the direction of this office, in August and September, 1856, of the entrances of South Black river and Kalamazoo river, in the State of Michigan.

It is to be regretted that the resolutions of the United States Senate of the 4th of August, 1856, marked F 2, were not followed up by an appropriation to bear the expenses of making the necessary examinations and surveys for obtaining accurately the information they call for. Had such means been provided, a full report could have been made of all that was applicable to the duties of this office, under the several heads enumerated. But, for the want of such means, I am not at present able to present anything more in regard to the several subjects than the results of the surveys above mentioned.

That in relation to South Black river, Michigan, is shown on the accompanying map, marked G, No. 50, drawn on a scale of $\frac{1}{2400}$ or

200 feet to 1 inch. The survey at this place was made in August, 1856, by my assistant, Mr. John R. Mayer, when *en route* between the harbors of St. Joseph and Black lake.

That in relation to Kalamazoo river, Michigan, is shown on the accompanying map marked G, No. 51, drawn on the same scale as the other. The survey here was also made by the same gentleman, between the 2d and 10th of September, 1856, when on the same expedition.

There are several other harbors and inlets on the coast of Lake Michigan which merit the attention of particular examinations and surveys in order to show their respective characters, the nature and extent of their commerce and navigation, and their susceptibility of improvement for the purposes enumerated in the resolutions. Among them I may be allowed to mention the following, viz:

1. Calumet, Illinois, on the southwestern coast of Lake Michigan.
2. Muskegan river and lake, on the east coast of Lake Michigan.
3. White river inlet, on the east coast of Lake Michigan.
4. Marquette inlet, on the east coast of Lake Michigan.
5. Riviere au Sable, (Sandy river,) on the east coast of Lake Michigan.
6 Maniskee river and lake, on the east coast of Lake Michigan.
7. Portage lake inlet, on the east coast of Lake Michigan.
8 Lac aux bec scis, (or saw bill lake,) on the northeast coast of Lake Michigan.
9. Platte river, on the northeast coast of Lake Michigan.
10. Bear lake, on the northeast coast of Lake Michigan.
11 and 12. Grand and Little Traverse bays and their estuaries, on the northeast coast of Lake Michigan.

There are also others near the entrance to Green bay, which are well worthy of examination.

Four well organized surveying parties would be enabled, in a single season, to make the requisite examinations and surveys of all these places, so that maps sufficiently minute could be rendered, showing their characters, their susceptibility of improvement, and their probable cost; also, the amount and value of the lake tonnage and commerce that would be benefitted thereby.

It is only by actual statistics, to be derived from mercantile and warehouse books, that this latter species of information can be obtained in a reliable manner.

I would respectfully recommend that an appropriation of ten thousand dollars ($10,000) be asked for, to be applied to making the necessary examinations and surveys at these several places, with a view to furnishing the information required the ensuing season, so far as regards the harbors and inlets on the coast of Lake Michigan.

F 1.

Colonel Abert to Colonel Graham.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, August 15, 1856.

SIR: You will please furnish, as far as it may be in your power to do so, the information called for by a resolution of the Senate, of the 4th instant, a copy of which is herewith enclosed.

Respectfully, sir, your obedient servant,

J. J. ABERT,
Colonel Corps Topographical Engineers.

Major J. D. GRAHAM, *Corps Topographical Engineers,*
Brevet Lieut. Colonel U. S. A., Chicago, Illinois.

F 2.

RESOLUTIONS.

IN THE SENATE OF THE UNITED STATES, *August* 4, 1856.

Resolved, That the President be requested to inform the Senate whether any general survey or other examination of the shores and islands of Lakes Superior, Michigan, Huron, St. Clair, Erie, Ontario, and Champlain, have been made, with a view to the location and erection of light-houses, buoys, harbors of refuge, or other improvements for the protection of vessels engaged in the navigation of those waters; and, if so, to communicate the results of such survey or other examination.

Resolved, That the President be required to communicate, also, whatever information can be derived from any of the departments in reference to the following points:

1. The number and general description of the vessels engaged in the navigation of each lake; the number of passengers and value of the property so transported, year by year, for the last eleven years; and the amount of duties paid at each port during the same period, or which would have been payable but for the provisions of the late treaty of reciprocity with the British-American possessions.

2. The number and location of the light-houses, buoys, harbors, and other improvements established by the government of the United States, and the amount expended for each improvement, (with the particular charges of expenditure,) during the last eleven years.

[3.] That the President be requested to inform the Senate, also, what additional improvements (whether light-houses, buoys, harbors of refuge, or of any other description) are necessary, in his opinion, to protect the navigation of the lakes above mentioned; at what places they ought to be erected, and, as far as possible, what should be the particular description and expense of each improvement.

[4.] And, also, in case the authorities or citizens of any locality upon either of the said lakes should undertake, or have undertaken, the erection of a harbor for commercial purposes, what proportion of the whole expense the government of the United States ought to pay, in his opinion, for the establishment and maintenance of such harbor as a harbor of refuge, and likewise by reason of the protection thereby afforded to the vessels and property of the government, or with a view to the increase of the public revenue?

[5.] And, also, whether it is practicable, and, in his opinion, expedient, to reserve, annually, a proportion of the duties levied or chargeable at each port of collection upon the said lakes, the same to be expended by the government, or by the local authorities, for the protection and improvement of commerce at each of such ports; and, if so, what proportion of the duties ought to be reserved.

Attest: ASBURY DICKINS, *Secretary*.

I will now proceed to describe the outlets of South Black river and Kalamazoo river.

13. SOUTH BLACK RIVER, MICHIGAN.

This river enters Lake Michigan twenty-five (25) miles north of St. Joseph, on the eastern coast. It has three principal branches, and waters a considerable tract of country productive in agricultural articles and in lumber. The inhabitants of the counties of Van Buren and Allegan would be much benefitted if the outlet of this river could be improved so as to allow the easy entrance of vessels drawing eight feet of water. At present, as the map will show, the mouth of the river is nearly closed for want of protection against the northwest winds.

The piers shown upon the map at the mouth of the river are mere bridge-wharves, resting on piles, for the landing of lumber and other merchandise, and not solid piers.

Two parallel piers, the north one 544 feet long, and the south one 448 feet long, and each 20 feet wide and eight feet high from the bottom to the water level, or 13 feet high from the bottom to the flooring at top, placed, say 180 feet apart, would suffice for this place.

The two piers, having a total length of 992 feet, would require 31 cribs, each 32 feet long. It would be applicable to this case to construct these cribs according to the drawings on sheet G, No. 19, now in the Topographical Bureau, and the specifications in the table marked T 1, to be found at pp. 12 to 15 of Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session.

Each crib thus constructed will cost, by an estimate I have made, hereto attached, marked F 3, $1,153 81; and at this rate the 31 cribs will cost.....	$35,768 11
To which add, for dredging 27,300 cubic yards of sand to make a channel 8 feet deep from where that depth now exists in the river above its mouth, to the same in Lake Michigan, at 12½ cents per cubic yard.....	3,412 50
Total estimated cost of such a harbor.....	39,180 61

F 3.

Estimate of the cost of one crib, 32 *feet long*, 20 *feet wide, and* 13 *feet high from the soil at bottom to the flooring at top*, or 8 *feet high from the soil at bottom to the water surface, to be constructed according to the drawings in sheet G, No.* 19, *in the Topographical Bureau, and also in the archives of the United States Senate at Washington, and also according to the specifications contained in table T* 1, *at pp.* 12 *to* 15 *of Senate (Ex.) Doc. No.* 16, *of the* 34*th Congress*, 3*d session.*

For 1,436½ lineal feet of pine timber, hewn 1 foot square, at 14 cents.	$201 11
For 880 lineal feet of white oak timber, hewn 1 foot square, at 18 cents	158 40
For 1,482 feet, board measure, of white oak plank, 3 inches thick, and 8 inches wide, for flooring, at $16 per M.	23 71
For 2,136 lbs. of 1-inch square wrought iron for bolts, at 4 cents per lb	85 44
For 136.8 lbs. of wrought iron spikes, ⅜ by ⅜ of an inch square, at 7½ cents	10 26
For 40 cords of ballast stone, at $8	320 00
For superintendence, carpentry, and labor	250 00
Sum	1,048 92
Add 10 per cent. for contingencies	104 89
Estimated cost of one crib	1,153 81

J. D. GRAHAM,
Major Corps of Top. Eng., Brevet Lieut. Col., Sup. Eng.
OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

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14. KALAMAZOO RIVER, MICHIGAN.

This river enters Lake Michigan nineteen (19) miles north of the mouth of South Black river, and nine (9) miles south of the mouth of Black river proper.—(See the 11th harbor, *ante*.)

As any map of the State of Michigan will show, this river is about two hundred miles long, following its sinuosities. It has its source in Hillsdale county, Michigan, and its general course is about W. N. W. Its general depth for eight miles from its mouth is eight (8) to twelve (12) feet.

It is navigable at all seasons for boats of 50 to 60 tons as high up as Allegan, a distance of about forty (40) miles.

It flows through the counties of Hillsdale, Jackson, Calhoun, Kala-

mazoo, and Allegan. There is great water power for manufacturing establishments on this river, and a rich surrounding country for agriculture.

The great impediment to business in the navigation is the shoal at its mouth, which prevents the passage between the river and Lake Michigan of vessels drawing more than five feet of water.

It is very desirable that a depth of full eight (8) feet should be secured over or through this shoal at all times.

For this purpose two rows of close piling of piles 1 foot square and ten feet apart, with the intermediate spaces filled with plank piles of white oak four (4) inches thick, and the whole bound together by longitudinal caps and stringers, to be placed just above the mouth of the river, as is drawn in red dotted lines upon the map, and two parallel piers projecting from the mouth of the river into the lake, as is also drawn in red dotted lines upon the map, with a channel-way between them two hundred and fifty (250) feet wide, would, I would suggest, be sufficient.

The channel, being thus confined to a uniform bed of the width represented, would afford scour enough to keep down the shoals when once dredged away, at least with the aid of a moderate degree of annual dredging.

Here the piers are drawn of equal length, being each 736 feet long, requiring for each pier 23 cribs, or for both piers 46 cribs, each 32 feet long, 20 feet wide, and 8 feet high from the bottom to the water surface, or 13 feet high from the bottom to the flooring at top. These cribs will be similar in all respects to those proposed in the preceding case for South Black river, which were estimated to cost each $1,153 81.

At this rate, the 46 cribs for Kalamazoo will cost.....	53,075 26
There will be for both sides of the river 2,610 lineal feet of close piling, at $3 per foot.....	7,830 00
For dredging 25,555 cubic yards of sand to give a channel 8 feet deep throughout from that present depth in the river to the same in Lake Michigan, at 12½ cents per cubic yard.....	3,194 37
Amount required for the improvement at the mouth of Kalamazoo river, Michigan.....	64,099 63

II.—LAKE ST. CLAIR HARBOR WORKS.

15. MOUTH OF CLINTON RIVER, MICHIGAN.

I ask a reference to my annual report (No. 161) of last year as containing the chief information I would now present in relation to this improvement. It is printed in Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session, at pp. 468 to 471.

The partial work done here in 1855 has had a beneficial effect on

the harbor entrance. When completed in accordance with the approved plan under which it was commenced, it is believed that all the benefits which were contemplated will be realized. The small balance of the former appropriation remaining on hand did not allow of active operations, in construction, the past season.

I beg leave to renew the estimate of the cost of completing this work which was presented last year. It will be found at page 470 of the above mentioned printed document.

It amounts to.....	$31,920 00
From which deduct the balance on hand, as per account rendered for the 3d quarter of 1857.....	512 83
Amount of appropriation required for Clinton river.....	31,407 17

For the reason stated in my report for last year, I would recommend that this sum be granted by two equal annual appropriations, each of $15,703 58.

III.—LAKE ERIE HARBOR WORKS.

16. MONROE HARBOR, MICHIGAN.

This harbor is at the mouth of the river Raisin, about 2⅓ miles below the town of Monroe.

The river has its source in Hillsdale county, Michigan, and flows for about 125 miles, measured by its channel, on a course generally easterly, through a very fertile and productive country. It is very important to the people of this back country that this harbor should be kept in good condition. No appropriations have been made for it since the year 1852, when there was one of $14,000. This has been expended in extending the south pier, and in rebuilding a portion of the north pier above the water level, so that there have been no funds appertaining to this harbor for the last two years. The works have, in consequence, deteriorated, as they always must under similar circumstances, and a larger amount is now required than was two years ago for putting the harbor in proper condition.

For this purpose I herewith present an estimate, marked G, amounting to $23,857 90.

Owing to the bad condition of this harbor, and the great liability to further injury from the lake storms the present autumn and winter, I think it very important that the above amount should be granted in one appropriation.

G.

Estimate of funds required for the repair of Monroe harbor, Michigan, and for the extension of both piers 160 *feet lakeward.*

1. The extension of the harbor piers.

This will require for each pier five (5) cribs, each 32 feet long by 20 feet wide, and 12 feet average height from the soil at bottom to the water surface, or 17 feet high from the bottom to the flooring at top.

For both piers there will be required ten (10) such cribs.

It is proposed to construct them in accordance with the drawings in sheet G, No. 20, now in the Topographical Bureau, and the specifications in table T 2, at pp. 16 to 18 of Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session.

The cost of each crib will be as follows:

For 1,961 lineal feet of pine timber, hewn 1 foot square, at 14 cents per lineal foot.....	$274 54
For 880 lineal feet of white oak timber, hewn 1 foot square, at 18 cents per lineal foot.....	158 40
For 1,482 feet, board measure, of white oak plank, for flooring, 3 inches thick and 8 inches wide, at $20 per M.....	29 64
For 2,660 pounds of 1-inch square wrought iron for bolts, at 4 cents per pound.....	106 40
For 137 pounds of wrought iron spikes, $\frac{3}{8}$ by $\frac{3}{8}$ of an inch square, pointed and headed, at $7\frac{1}{2}$ cents per pound....	10 28
For 53 cords of hard boulder stone, at $6 per cord.....	318 00
For labor, carpentry, and superintendence.....	400 00
	1,297 26
Add 10 per cent. for contingencies.....	129 72
Estimated cost of one crib.....	1,426 98

Then, ten cribs, at $1,426 98 each, give—

1. Cost of the pier extensions to 12 feet water in lake Erie.....	$14,269 80
2. For renewal of the superstructure of the north pier for 350 feet, at $18 per foot.....	6,300 00
3. For repair of 250 feet of pier work, at $7 50 per foot	1,875 00
4. For dredging 10,870 cubic yards, at 13 cents per cubic yard.....,.....	1,413 10
Amount required for Monroe harbor, Michigan...	23,857 90

J. D. GRAHAM,
Maj. Top. Eng., Bvt. Lieut. Col., Sup. Eng.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, September 30, 1857.

17. SANDUSKY HARBOR, OHIO.

No appropriation has been made for this harbor since the year 1852. An appropriation of $15,000 was granted that year, which was all expended two years ago in making important improvements.

I cannot better present the importance of this harbor, and the present demands for its security than by referring to the last annual report of Captain Stansbury, of the corps of Topographical Engineers, dated October 6, 1856. Captain Stansbury was then in charge of this and other works on Lake Erie. His report is hereto attached, marked H.

I will also renew his estimate, presented at the same time, of the funds required for this harbor. It amounts, as will be seen, to the sum of $112,117.

I would recommend that it be granted in two equal annual appropriations of $56,058 50 each.

H.

Copy of the annual report of Captain Howard Stansbury, of the United States Topographical Engineer corps, to Colonel J. J. Abert, Chief Topographical Engineer, dated October 6, 1856.

HARBOR OF SANDUSKY, OHIO.

The amount appropriated for the improvement of this harbor was $15,000, the whole of which has been expended.

The improvement consists of a line of rough cribs constructed along the crest or axis of Peninsula Point, a long, narrow spit of sand extending from a small island near the main shore to a point opposite to Cedar Point, and intervening between the lake and Sandusky bay, of which latter it forms the northern boundary, and by which alone it is separated from the lake. This spit, or sand beach, had been gradually washing away, under the repeated assaults of northerly gales, the effect of which, if continued, would have been to destroy it entirely, and thus to throw open the whole of this magnificent sheet of water to the lake, changing its character from that of a well sheltered bay to that of an open roadstead, exposed to all the fury of northern, northeastern, and northwestern storms.

The consequences could not but prove disastrous to the prosperity of the flourishing city of Sandusky, situated upon its southern bank, by throwing open its whole water front to the full rake of the lake storms, rendering its docks and wharves useless, filling up the channel in its front, and utterly destroying its harbor.

To prevent the destruction of this spit, this line of cribs was constructed upon the surface of the sand, with the expectation that the weight of stone with which they should be filled would gradually sink them until they should attain such a depth as would not only serve as a barrier against the sea, but would also form a nucleus for a new beach, which, thus protected, would not be liable to wash away

again. As heretofore reported, the experiment has proved completely successful. A new and extensive beach has formed on both sides of the line of cribs, which is becoming covered with bushes, which, by their spreading roots, will materially assist in giving cohesion and stability to the new formation.

The whole length of the spit is 7,500 feet, of which 3,357 feet have been protected in the manner described, leaving rather more than 4,000 feet yet to be constructed to render it secure its whole length. Similar crib work will be required across the small island above mentioned, which although covered with trees, is, like the spit, rapidly washing away, and, unless protected in like manner, will, ere long, entirely disappear, or be converted into a bed of shifting sand.

The distance across the island is 450 feet.

From the island to the main shore, a distance of nearly 3,000 feet, a breach exists which was made many years ago, through which the water flows from the lake into the bay, and out again into the lake, with every shift of wind. During the prevalence of northerly gales, the water rushes through this cut with great force and velocity. The depth is from four to six feet.

The existence of this breach has a very material influence upon the depth of water at the entrance of the bay, for such a large volume of water discharging itself into the lake by the cut cannot but sensibly diminish the amount that would otherwise pass out by the mouth of the harbor, and consequently seriously affect the entrance of large or heavily laden vessels.

To complete the improvement of this harbor, it is proposed to close this breach entirely upon the line indicated upon the chart by a pier or breakwater of crib work, which, in connexion with that proposed across the island and along the crest of the spit, will form a continuous and permanent barrier against the lake, from the main land to the termination of Peninsula Point at the mouth of the bay. The effect will be to force all the water to pass out of the bay between the two points at its mouth, and thus to keep open and deepen the water in the channel.

The work already done toward this end has been inspected the present season, and found to stand as perfectly as was expected.

The cribbing put down along the spit has sunk in the sand, the tops of the cribs being in some instances two or three feet below the surface of the new beach, and should be *built upon* until they reach the clay or rock beneath, when no further attention to them will be necessary. The width and height of the new beach has materially increased since last year, and the complete success of the improvement is clearly demonstrated.

Estimates for the completion of the improvement upon the plan proposed, were submitted in 1854 and 1855, and are now renewed; as was remarked at that time, the appropriation for closing the breach, if made at all, should cover the whole estimated cost at once, that there may be no delay for want of funds, as was the case in a previous attempt to close this same breach. The work was commenced, but owing to the inadequacy of the appropriation, it was, of necessity, left unfinished. The waves from the lake rushing through the partially

filled gap, soon demolished what had been done, and there remains now but the ruin of one single crib to show that such a structure was ever contemplated.

Estimate of funds required to continue the improvements of the harbor of Sandusky—renewed:

To complete the line of rough pier on Peninsula Point to its extremity, 4,050 feet of pier, at $4 50.....	$18,900 00
To construct an entire new breakwater to close the breach between the western extremity of Peninsula Point and the main land, 2,700 feet long, 20 feet wide, and 14 feet high; 90 cribs of 30 feet, at $900 per crib.....	81,000 00
To connect the above breakwater, by a line of rough cribs across the island, with the pier already built, 450 feet of rough pier, at $4 50.....	2,025 00
Add 10 per cent. for contingencies.....	10,192 00
Total for Sandusky harbor.....	112,117 00

18. HURON HARBOR, OHIO.

For a description of this harbor, and an understanding of its importance as a refuge from the lake storms, I beg leave to refer to the report of Captain Stansbury, as printed in part 2d of Senate (Ex.) Doc. No. 1, of the 34th Congress, 1st session, at pp. 395 and 396.

Captain Stansbury's estimate of funds required for improvements and repairs of this harbor, on the 30th of September, 1855, and renewed in his report of October 6, 1856, amounted to $36,303 02

Which I would adopt by adding for damage done by the late storm, 10 per cent.....	3,630 30
And an estimate for dredging.....	1,250 00
Amount required for Huron harbor, Ohio.....	41,183 32

No work has been done for this harbor for two years for the want of appropriations. The last made was for $10,000, in 1852, which was expended.

I would recommend that thirty thousand dollars ($30,000) of the above estimate be granted at once, and the balance of $11,183 32 in the year 1859.

19. VERMILLION HARBOR, OHIO.

I beg leave to renew the estimate made by Captain Stansbury, United States Corps of Topographical Engineers, for this harbor, in his report to the Topographical Bureau of September 30, 1855, which

will be found printed in Senate (Ex.) Doc., No. 1, of the 34th Congress, 1st session, at pp. 393 and 394, of part 2d.

The estimate amounts to $42,856 61.

I would recommend the granting of that sum in two equal annual appropriations, of $21,428 30 each.

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20. BLACK RIVER HARBOR, OHIO.

The last appropriation made for this work was $5,000, which was expended upon it in the year 1852. It was, however, insufficient, and left the work still in a very dilapidated condition.

Captain Stansbury's last estimate for the repairs of this work will be found printed at pp. 392 and 393, of the last mentioned Senate document.

The items are given in detail, and amount to.....	$30,801 76
For increased dilapidation, I would add 10 per cent.....	3,080 17
Amount required.....	33,881 93

I would recommend that it be granted in two equal annual appropriations, of $16,940 96.

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21. CLEVELAND HARBOR, OHIO.

This is one of the most important harbors on our lake coast, and it is highly important to the commerce of the lakes that it should be kept in good condition.

In regard to the work which was accomplished with the last appropriation, I would refer to the reports of Captain Stansbury of the 30th of September, 1855, and the 6th of October, 1856, when it was under his charge. The first will be found printed at pp. 388 to 392 of the above mentioned Senate document, and a copy of the last is herewith presented, marked I. It will be seen that his estimate for completing the improvement is $44,757 87.

No appropriation has been granted for this work since 1852.

I would adopt the estimate as given in detail by Captain Stansbury, and would recommend, with a view to the timely collection of the requisite materials, that the above sum be granted in one appropriation of $44,757 87.

I.—*Copy of the annual report of Captain Howard Stansbury, of the United States Topographical Engineer Corps, to Colonel J. J. Abert, Chief Topographical Engineer, dated October* 6, 1856.

HARBOR OF CLEVELAND.

The balance available for this work, as reported in 1855, was $5,000.

During the present season the pier-head at the end of the west pier, 54 feet wide, has been laid down in 14 feet water and carried up eight feet above the surface. One hundred and ten feet of new pier has been built (inside) in a depth of 12 feet water, partly on the foundation of the old work, and the whole has been filled with stone.

The new pier, 800 feet in length, continues to answer the expectation formed of it as to solidity and alignment, and has resisted the severe storms of the past winter without the slightest appearance of settling or displacement.

The dilapidation of the outer end of the east pier (stone) continues gradually to increase under the action of the elements, and the necessity for its repair becomes greater from day to day. The removal of a portion of the parapet wall the past season by order of the bureau will furnish material sufficient for that purpose, with the exception of a facing, which should be of a stone of a harder and more enduring character.

Estimate of funds required for continuing the improvement of the harbor of Cleveland, (renewed from the report of 1855.)

WEST PIER.

For completing the west pier its present length, connecting the two piers, and planking the whole fifty feet wide.....	$21,467 93
Contingencies 10 per cent.....	2,146 79
Total for west pier.....	23,614 72

EAST PIER.

For removing the old stone work of the outer end of the east pier, destroyed by a steamboat, and rebuilding it, (labor only, materials on hand).	$6,877 20
For tearing up the wooden platform north of the beacon, and replacing it with a structure of masonry to correspond with the rest of the pier, and form a solid structure.....	15,152 50
For tearing away the wooden crib surrounding the beacon, and to replace the same with a structure of masonry connecting it with the pier-head proposed to be rebuilt as above.....	4,113 45
Total for east pier.....	26,143 15

Recapitulation.

West pier	$23,614 72
East pier	26,143 15
Sum	49,757 87
Deduct appropriation on hand September 30, 1855	5,000 00
Amount	44,757 87

22. GRAND RIVER HARBOR, FAIRPORT, OHIO.

There are no funds remaining of the appropriation of ten thousand dollars ($10,000) made for this harbor in 1852. This sum was all expended more than two years ago in making the repairs that were most needed, but it was inadequate for all the work which was then required here.

Besides certain repairs that are still necessary, I would recommend that the two harbor piers be at once extended; the east pier to be prolonged a distance of 416 feet in its present direction, and the west pier 320 feet parallel with the other, beginning at the point which was suggested in the report of Mr. J. A. Potter, the former agent here, of September, 1853. Unless an extension of this sort be made, it will be difficult to keep the harbor entrance clear. Some dredging will also be required here.

For these several objects I herewith present an estimate, marked K, amounting to $41,498 94.

As it is very important that the work should be completed as soon as possible, I would recommend that this sum be granted in one appropriation.

K.

Estimate of funds required for extending the east pier of Grand River harbor, (at Fairport,) Ohio, 416 feet, the west pier 320 feet; total, 726 feet of new pier work. Also for making repairs, and dredging, as herein specified.

1. FOR THE NEW PIER WORK.

This will require, for the east pier extension 13 cribs, and for the west pier extension 10 cribs; or, for both piers 23 cribs, each 32 feet long, 20 feet wide, and 12 feet high from the bottom to the water surface, or 17 feet high from the bottom to the flooring at top.

It is proposed to construct the cribs as in the case of estimate G, given under the head of Monroe harbor, Michigan. The prices of

materials and workmanship will be the same in the two cases. We therefore assume the cost of each crib for Grand River (Fairport) harbor to be, including workmanship, superintendence, and contingencies, $1,426 98.

1. Then both pier extensions will cost $1,426 98 × 23 = 32,819 39.

2. FOR REPAIRS, INCLUDING THE TEARING AWAY SOME OLD WORK AND RENEWING.

This will require the following materials and workmanship, viz:

For 23,840 lineal feet of pine timber, hewn 1 foot square, at 14 cents per lineal foot	$3,337 60
For 7,500 lineal feet of white oak timber, hewn 1 foot square, at 18 cents per lineal foot	1,350 00
For 7,530 pounds of 1-inch square wrought iron for bolts, at 4 cents per pound	301 20
For 410 pounds of wrought iron spikes for flooring, at 7½ cents per pound	30 75
For 3,000 feet, board measure, of 3-inch oak plank, at $20 per thousand	60 00
For 100 cords of stone, at $6 per cord	600 00
For workmanship, superintendence, &c	500 00
2. Total for repairs, &c	6,179 55

3. FOR DREDGING.

This will require the excavation and removal of 12,500 cubic yards of earth and sand, at 14 cents per cubic yard	$1,750 00
For repairs of steam-dredge	750 00
3. Total for dredging	2,500 00

RECAPITULATION.

1. For the pier extensions	$32,819 39
2. For tearing away old work and making repairs	6,179 55
3. For dredging and repairs of steam-dredge	2,500 00
Amount required for Grand River harbor, (Fairport,) Ohio	41,498 94

J. D. GRAHAM,
Maj. Corps Top. Eng., Bvt. Lt. Col., Sup'g Eng., &c.

OFFICE GEN. SUP. OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

23. ASHTABULA HARBOR.

The last appropriation made for this harbor was ten thousand dollars, ($10,000,) granted in 1852. The whole of it was expended by the end of the year 1855, in making repairs and in extending the harbor piers according to the approved plans. Full reports have been made by my predecessors in charge of the work done.

To complete this harbor, the windward pier should be extended out 416 feet, and the leeward pier, say 288 feet.

This will require for the first, 13 cribs, and for the second, 9 cribs; or, for both piers, 22 cribs, similar in all respects, and costing the same per crib as in estimate G, presented under the head of Monroe harbor, Michigan—that is to say, $1,426 98 per crib.

Then 22 cribs, at $1,426 98 each.....	$31,393 56
For repairs of present piers.....	5,500 00
For dredging, say 8,000 cubic yards, at 14 cents per cubic yard.....	1,120 00
Total required for Ashtabula harbor, Ohio.....	38,013 56

I would recommend that this sum be granted in two equal annual appropriations, each to be $19,006 78.

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24. CONNEAUT HARBOR, OHIO.

The last appropriation for this harbor was ten thousand dollars, ($10,000,) granted in the year 1852.

Captain Stansbury, my predecessor in charge, states in his annual report to the Topographical Bureau of the 30th of September, 1856, that with this sum "eight hundred and ninety (890) feet of pier have been entirely rebuilt upon the foundation of the old work, one hundred and twenty (120) feet thoroughly repaired; a new crane scow built, and a complete survey and chart of the harbor made and transmitted to the bureau.

A new appropriation is now needed to complete the piers of this harbor. They do not at present extend to 12 feet depth of water. To do this will require that the west pier be prolonged 352 feet, and the east pier 288 feet. The first will require an addition of eleven (11) cribs, and the second an addition of nine (9) cribs, each 32 feet long; total for both piers 20 cribs, similar, and costing the same per crib as is stated in detail in estimate G, presented under the head of Monroe harbor, Michigan—that is to say, $1,426 98, including superintendence, workmanship, and all contingencies.

Then 20 cribs, at $1,426 98 each, give for the cost of the pier extensions	$28,539 60
To which add :	
For repairs of present piers	500 00
For dredging 18,000 cubic yards, at 14 cents per cubic yard	2,520 00
Amount required for Conneaut harbor, Ohio	31,559 60

I would recommend that this be divided into two equal annual appropriations, each of $15,779 80.

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25. ERIE HARBOR, PENNSYLVANIA.

The whole of the last appropriation made by Congress for this harbor has been expended upon it, and it has been a matter of great regret that there have not been means in hand for making certain repairs that are greatly needed here.

The north channel pier is in bad condition at several points where, in consequence of breaches, a portion of the stone ballast has been washed out, and the ties have given way.

The north breakwater pier is also in bad condition from similar causes. The action of the sea in every gale of wind increases these damages ; and if they be not soon repaired, the harbor must be seriously injured. Such a catastrophe would be very injurious to the commercial interests of Erie, and to those of the other lake ports in rade with Erie.

The south channel pier is generally in good condition, though even here some slight repairs are necessary.

Dredging to the amount of seventeen thousand (17,000) cubic yards on the inner bar, and ten thousand, (10,000) cubic yards on the outer bar, is necessary to enable vessels drawing as much as nine (9) feet to enter and depart without difficulty. For these several objects, I herewith present an estimate, marked L 1, amounting to $8,638.

I would recommend that this sum be granted in one appropriation, and with as little delay as possible, because the longer the breaches in the piers are allowed to remain unattended to, the more costly it will be to repair them.

I gather from the last year's annual report of Brevet Colonel Turnbull, of the corps of Topographical Engineers, my predecessor in charge of this and the other lake harbor works eastward of this point, that "the measures recommended by the board of engineers as necessary to give full value to the natural advantages of this harbor are—

1. The modifications, repair, and extension of the present piers at the eastern entrance, to secure the proper depths of water between the lake and the bay, or habor, within.

2. The construction of channel piers to form a western entrance at

or near the breach in Peninsula Point, and the security of the beach on either hand.

3. The checking of the abrasion, and restoring of the original water line of the island as far as this may be practicable.

The board recommended that the eastern entrance be increased to five hundred (500) feet in width, by building a new south pier and removing the old one, and, also, to extend the north pier into twelve (12) feet water. They also recommended the construction of piers and breakwaters to form an entrance at the west end of the bay; to close the present breach in the peninsula, and to prevent the abrasion of the beach by brush work. It is also suggested by them that the small balance of the appropriation on hand (at that time) be applied to the latter object, as a measure of pressing necessity in view of the safety of this valuable harbor."

Colonel Turnbull's report,* dated September 1, 1856, goes on to state that his operations in the years 1855 and 1856 were confined to this latter object, namely, the closing of the breach in the peninsula, and the protection of the beach or shore by brush wood, and that his experiments proved successful.

I will here add that the good effects of this measure continue to be apparent.

The estimate of the board of engineers of the cost of completing this harbor in a permanent manner, according to their plan as above detailed, was as follows, viz: (See page 385, of part 2d of Senate (Ex.) Doc. No. 1, of the 34th Congress, 1st session.)

1. For the eastern entrance.....	$56,760 00
2. For the western entrance.....	212,345 37
Total.....	269,105 37

For the new pier work to form the breakwater and piers contemplated in the plan, the board assumes eight hundred dollars (800) for the cost of a single crib to be placed in twelve feet depth of water, and to be thirty feet long, twenty feet wide, and seventeen feet high from the bottom to the flooring at top. This [illegible] must have been, we think, founded on prices for materials and labor which are not now applicable. There is no case of pier work for a harbor requirng more strength in the structures, in order to resist the force of the lake sea, than that here contemplated. Under this impression we have felt it to be due to the subject to present, for consideration, a new estimate for this work. It is hereto attached, marked L 2, amounting to the sum of $417,499 95.

sum

In arriving at this result we have estimated no higher for the several items of cost and labor than what we have ascertained to be actual business prices.

Our estimate of the cost of a single crib, thirty-two feet long, twenty feet wide, to be exposed to the action of a strong lake sea in severe storms, in twelve feet water, is $1,525 16. We do not think it can

*In manuscript in the Topographical Bureau, at Washington.

with safety be reduced. It is less than we have, in several cases, estimated for a crib of the same dimensions for works of a similar character on Lake Michigan.

In the cases of Black lake and Grand river, on Lake Michigan, (see estimates D and E, *ante*,) where the crib is of the same dimensions as in the present case, the estimate is $1,696 80 per crib.

In view of the great importance of this harbor, and the extent and value of its commerce, we would recommend that our estimate for its completion, in accordance with the plan of the board of engineers, namely, four hundred and seventeen thousand four hundred and ninety-nine dollars and ninety-five cents ($417,499 95) be granted in four equal annual appropriations, each of $104,374 99. The first year's appropriation to be augmented by the amount of estimate L 1, being for repairs required immediately, viz: $8,638; which would make the first year's appropriation $113,012 99; that is to say, one hundred and thirteen thousand and twelve dollars and ninety-nine cents for the first year. This would conduce to economy in allowing materials to be procured in advance.

No work could be carried on at this harbor by the United States the past season, because the last appropriation was exhausted.

In February last a number of the citizens, ship owners and others, of Erie, applied for the use of the United States steam dredge lying at that place, for the purpose of dredging the channel. A favorable action was taken upon the application, which was approved by the Topographical Bureau and the War Department; and the parties were informed that the dredge could be used for the purpose desired, under the control of this office, and in accordance with the established rules of the government in such cases, with which they were made acquainted. After a considerable portion of the season had elapsed, however, they declined the use of this machine, and no dredging was done. The papers hereto attached, marked from L 3 to L 7, relate to this subject.

L 1.

Estimate of funds required for the immediate repair of the piers of Erie harbor, Pennsylvania, and for dredging.

1. For the north channel pier:

70	cords of stone, at $7 per cord	$490 00
2,000	pounds of one inch square wrought iron for bolts, at 4 cents per pound	80 00
1,500	lineal feet of timber, hewn one foot square, (on hand, and no charge.)	
For superintendence, carpentry, and labor.		300 00
Contingencies		150 00
	Total for the north channel pier	1,020 00

2. For the south channel pier:	
15 cords of stone, at $7 per cord	$105 00
750 pounds of one inch square wrought iron for bolts, at 4 cents per pound	30 00
300 lineal feet of one foot square timber, (on hand, and not charged.)	
For superintendence, workmanship, and contingencies	50 00
Total for the south channel pier	185 00
3. For the north breakwater pier:	
139 cords of stone, at $7 per cord	973 00
2,500 pounds of one inch square wrought iron for bolts, at 4 cents per pound	100 00
16,500 lineal feet of one foot square timber, (on hand, and not charged.)	
For superintendence, labor, carpentry, and contingencies	800 00
Total for the north breakwater pier	1,873 00
4. For the dredging:	
For dredging and removing 17,000 cubic yards from the inner bar, at 18 cents per cubic yard	3,060 00
For dredging and removing 10,000 cubic yards from the outer bar, at 25 cents per cubic yard	2,500 00
Total for the dredging	5,560 00

Recapitulation of items.

1. For repairing the north channel pier	1,020 00
2. For repairing the south channel pier	185 00
3. For repairing the north breakwater pier	1,873 00
4. For dredging	5,560 00
Amount required for immediate repairs of Erie harbor piers	8,638 00

J. D. GRAHAM,
Major Top. Eng. Corps, Br't Lieut. Col., Sup. Eng'r.
OFFICE GENERAL SUPERINTENDENCE
OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

L 2.

Estimate of the cost of completing Erie harbor, Pennsylvania, according to the plan of the board of engineers.

It appears by reference to page 385 of part 2 of Senate (Ex.) Doc. No. 1, of the 34th Congress, 1st session, that the new piers and pier extensions proposed to be erected, will occupy a depth of 12 feet of water, and will be 17 feet high from the soil at bottom to the flooring at top. To these works there should be given the strength at least which is indicated by the plan of construction shown by the drawings in sheet G, No. 20, now in the Topographical Bureau, corresponding to the specifications contained in table T 2, at pages 16 to 18 of Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session.

Under this plan the cost of a crib 32 feet long, 20 feet wide, and 12 feet high from the bottom to the water surface, or 17 feet high from the bottom to the flooring at top, taking the present prices of materials and labor, will be as follows, viz:

For one crib:

For 1,961 lineal feet of pine timber, hewn 1 foot square, at 16 cents per lineal foot	$313 76
For 880 lineal feet of white oak timber, hewn 1 foot square, at 18 cents per lineal foot	158 40
For 1,482 feet, board measure, of white oak plank, for flooring, 3 inches thick, and 8 inches wide, at $18 per M	26 67
For 2,660 pounds of 1 inch square wrought iron, for bolts, at 4 cents per pound	106 40
For 137 pounds of wrought iron spikes, $\frac{3}{8}$ by $\frac{3}{8}$ of an inch square, pointed and headed, at $7\frac{1}{2}$ cents per pound	10 28
For 53 cords of hard stone, of proper size for crib ballast, at $7 per cord of 128 cubic feet	371 00
For superintendence, carpentry in framing, labor, floating to position, and sinking	400 00
Sum	1,386 51
Add 10 per cent. for contingencies	138 65
Estimated cost of one crib	1,525 16

1. For the eastern entrance:

North channel pier extension, 430 feet long, = $13\frac{14}{32}$ cribs, at $1,525 16 each	$20,494 33
South channel pier, (new line for a channel way 500 feet wide) 1,070 feet long, = $33\frac{14}{32}$ cribs, at $1,525 16 each	50,997 53
Removing 580 feet of present south pier, 12 feet wide, to a depth of 12 feet, at $20 per lineal foot	11,600 00
Estimated cost for eastern entrance	83,091 86

2. For the western entrance:

North channel pier, 1,650 feet long,= $51\frac{18}{109}$ cribs, at $1,525 16 each	$78,641 06
South channel pier, 2,190 feet long,= $68\frac{14}{32}$ cribs, at $1,525 16 each	104,378 13
North breakwater, 2,280 feet long,= $71\frac{8}{32}$ cribs, at $1,525 16 each	108,667 65
Brush-work facing, 4,720 feet of shore north of Barrack Point, 50 feet wide,= 26,222 square yards, at $1 25, (estimate of the board of engineers)	32,777 50
Brush-work facing, 1,000 feet of shore, south of Barrack Point, 50 feet wide,= 5,555 square yards, at $1 25 (estimate of the same)	9,943 75
Estimated cost of western entrance	334,408 09

Recapitulation.

Eastern entrance	$83,091 86
Western entrance	334,408 09
Total amount to complete Erie harbor, Pennsylvania, in a permanent manner	417,499 95

J. D. GRAHAM, *Major Corps Top. Eng's,*
Br't Lieut. Col., Sup'g Eng'r, &c., &c.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, September 30, 1857.

L 3.

Colonel Graham to Colonel Abert.

No. 171.] OFFICE GENERAL SUPERINTENDENCE &c.,
Chicago, April 3, 1857.

SIR: I have the honor to refer to the bureau the application of certain ship owners of Erie, Pennsylvania, hereto attached, (marked L 4,) for the use of the United States steam dredge, now lying at that place, to be employed at their expense in dredging Erie harbor.

I respectfully recommend that the application be granted, on the same conditions which were specified in the case of the dredging done on St. Clair flats by a United States steam dredge, under the direction of this office, in the year 1855.

I am, very respectfully, sir, your obedient servant,

J. D. GRAHAM, *Major Top. Eng's,*
Br't Lieut. Col. Sup'g Eng'r.

Colonel J. J. ABERT,
Chief Top. Engineer, Washington.

L 4.

Citizens of Erie, Pennsylvania, to Lieut Colonel Graham, superintending engineer of Lake harbor works.

ERIE, *February* 20, 1857.

The petition of the undersigned ship owners and others residing at Erie, respectfully represent, that the channel leading into the harbor at this place has become so shallow as to materially interfere with the navigation thereof. They therefore request that you will be pleased to permit them to use the dredge now lying in said harbor, for the purpose of dredging out and deepening the same; and in case their petition shall be granted, they hereby pledge themselves to return the same in as good order as received at any time when required.

CURTIS & BOYCE,
JNO. CLEMENS,
STARR & PAYNE,
JNO. HEAM & CO.,
CHAS. M. REED,
C. M. TIBBATS,
A. SCOTT.

Lieut. Colonel J. D. GRAHAM,
Superintending Engineer for Western Lakes.

L 5.

Colonel Abert to Colonel Graham.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, April 13, 1857.

SIR: Your letters, Nos. 170, 171, and 172, have been received. The use of the United States dredge boat, &c., at Erie, can be allowed on the conditions stated in your letter. The course pursued in relation to the dredge boat at Oswego, is approved.

Respectfully, sir, your obedient servant,

J. J. ABERT,
Colonel Corps Topographical Engineers.

Lieut. Colonel J. D. GRAHAM,
Corps Topographical Engineers, Chicago, Illinois.

L 6.

Colonel Graham to Colonel Abert.

No. 183.] OFFICE GENERAL SUPERINTENDENCE, &C.,
Chicago, September 3, 1857.

SIR: Notwithstanding the approval by the War Department and Topographical Bureau of the terms upon which the petition of certain citizens of Erie, Pennsylvania, was granted for the use of the United

States dredge boat, now at Erie in dredging that harbor, the dredge has never been so used. The said citizens, after their request was granted under the usual terms which have prevailed in similar cases, declined them. The dredge boat and her scows are left in a situation requiring immediate attention for their repair and preservation, and as there are no public funds appertaining to the Erie harbor improvement that can be applied to this object, I propose, if it meet your approval and that of the War Department, to have those repairs made immediately, and the cost charged proportionally to the balances of the appropriations remaining for the harbor improvements at Buffalo and Dunkirk, on Lake Erie, which will hereafter require dredging, and which are therefore interested in the preservation of the dredge boat and her scows.

I respectfully ask an answer, addressed to me at Erie, Pennsylvania.

Iam, very respectfully, your obedient servant,

J. D. GRAHAM,
Major Topographical Engineers,
Brevet Lieutenant Colonel, Superintending Engineer.

Colonel J. J. ABERT,
Chief Topographical Engineer, Washington.

P. S.—The small balance of $386 63, appertaining to this dredge, is not sufficient to pay for the requisite repairs, and it is necessary to appropriate it to the pay of a watchman to reside on board, for the care of the dredge during the winter.

J. D. GRAHAM,
Brevet Lieutenant Colonel, &c.

L 7.

Colonel Abert to Colonel Graham.

BUREAU TOPOGRAPHICAL ENGINEERS,
Washington, November 11, 1857.

SIR: The proposition in your letter No. 183, of September 3, 1857, to have the dredge boat at Erie repaired, and the expenses charged proportionally to the balances of appropriations for the harbors of Buffalo and Dunkirk, has been approved by the Hon. Secretary of War.

Respectfully, sir, your obedient servant,

J. J. ABERT,
Colonel Corps of Topographical Engineers.

Lieutenant Colonel J. D. GRAHAM,
Corps Topographical Engineers, Chicago, Illinois.

26. DUNKIRK HARBOR, NEW YORK.

No work has been done at this harbor the present season, for want of an appropriation. The small balance of $337 77 (three hundred and thirty-seven dollars and seventy-seven cents,) remaining from the last appropriation, will have to be immediately applied, together with a portion of the small balance appertaining to Buffalo harbor, in repairing the United States steam dredge boat, on lake Erie.* Congress failed to make appropriations for the current expenses and repairs of the steam dredges on the lakes; consequently, these expenses have to be borne out of the appropriations made directly for the harbor improvements, wherever dredging is included in the plan of improvement.

The lake gales of last winter and spring, and of the present autumn, have caused the works here to be damaged to the extent of the estimate herewith presented, marked M, amounting to the sum of $5,299 96.

I would recommend an immediate appropriation of that sum to be applied with as little delay as possible to the repairing of these damages. If neglected, they will go on to increase with every gale.

For full information in regard to the plan projected by the board of engineers, and approved by the War Department, for the protection of this harbor, I beg to refer to the annual report of Brevet Colonel William Turnbull, of the corps of Topographical Engineers, of September 1, 1855, to be found printed at pp. 382 to 384 of part 2d of Senate (Ex.) Doc. No. 1, of the 34th Congress, 1st session.

The importance of the harbor is greatly increased from its being the terminus, on lake Erie, of the New York and Erie railroad. This places it in the category of harbors which are of great importance to the lake commerce generally. In addition to the information therein contained, Colonel Turnbull adds, in his annual report for the year 1856,† as follows, viz:

"Eight (8) cribs of thirty feet in length, and in an average depth of nineteen (19) feet, were placed in the west breakwater, but boisterous weather set in unusualy early in the fall, and the work was necessarily left in an unfinished state, and the remarkably rigorous winter caused great destruction of the work.

"Five of the eight cribs were wrecked by the ice. Crib No. 8 was carried off entirely, and the others were cut down to various depths below the surface of the water. The work was resumed this season [that is in 1856] on the 17th May, but has been very much retarded in consequence of having to build on the *debris* of the old work, much of which had to be removed, and the new work fitted to the old. Although the season has been rather boisterous for work, yet very good progress has been made. The part wrecked last winter has been rebuilt, and some addition will be made to the length of the breakwater before the season closes."

The estimate of the board of engineers for completing this work will be found printed at pages 383 and 384 of the last mentioned document. The amount of the estimate is $192,600 81.

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* See documents marked L 6 and L 7, under the head of Erie harbor.

† In manuscript in the Topographical Bureau.

Here we are again compelled to present a new estimate of the cost of constructing this work in accordance with the plan of the board. The plan, we may be permitted to say, is able, and well adapted to the wants of commerce, if the work be constructed in a manner to render it permanent in its character; otherwise constructed, it would soon become useless for the purposes intended to be subserved by it.

For a work like this to be founded in a depth of eighteen (18) feet of water, and subject, as it will be, to be battered in every gale by a powerful action of the lake sea, the strength appertaining to the plan of construction shown by the drawings in sheet G, No. 21, or our case 3d of crib work now in the Topographical Bureau, and corresponding to the specifications to be found in the table T 3, at pp. 18 to 21 of Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session, ought at least, I would suggest, to be insured to it.

According to this rule, the cribs for the breakwaters will be, each, 30 feet long, 23 feet high from the soil at bottom to the flooring at top, and they will be 25 feet wide.

The cost of such a crib, according to the accompanying estimate, marked M 2, will be $2,466 28.

Cost of completing the harbor.

According to the lengths of the several breakwaters as they are given in the plan of the board, and assuming the cost of each crib of 30 feet in length to be as above, the cost of completing this harbor will be as follows, viz:

1. Western breakwater, 1,000 feet long, = 33⅓ cribs, at $2,466 28 each.....	$82,209 33
2. Middle breakwater, 2,890 feet long, = 96⅓ cribs, at $2,466 28 each.....	237,584 97
3. Eastern breakwater, 765 feet long, = 25½ cribs, at $2,466 28 each.....	62,890 14
Sum	382,684 44
To which should be added for contingencies, such as losses and damages from the lake storms while the work progresses in an unfinished state, 5 per cent.....	19,134 22
Total for completing this harbor.....	401,818 66

That is to say, four hundred and one thousand eight hundred and eighteen dollars and sixty-six cents for 4,655 feet, lineal, of breakwater pier work.*

Such a harbor, constructed upon principles to render it durable and reliable as a port of refuge in times of severe storms, would not only be a valuable acquisition to the general navigation and commerce carried on through the chain of our great lakes, but is absolutely

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* This is at the rate of $86 32, *nearly*, per lineal foot for a depth of 18 feet of water.

necessary for our navy in times of war. Taken in connexion with this view of the subject, the cost, as above presented, is surely not an objection. It is not more than might ensue from the disasters of a single season to an armed fleet, if deprived of such a port of refuge on this lake.

Colonel Turnbull, in his annual report for the year 1855,* states the annual amount of tonnage arriving at and departing from this place to be three hundred thousand (300,000) tons.

In his report for the year 1854,† he states the amount of the commerce of this port to have been, for the year ending August 31, 1854, as follows, viz:

Receipts by lake shipment	$10,000,400
Receipts brought for shipment by the Erie railroad	15,000,000
Receipts of provisions for local use	365,113
Total	25,365,513

I would recommend that the amount of our estimate for completing this work ($401,818 66) be granted in five equal annual appropriations of $80,363 73. This sum, increased by the amount of estimate M 1 ($5,299 96) required for immediate repairs, will increase the amount required the first year to the sum of $85,663 69.

M 1.

Estimate of funds required for the immediate repair of Dunkirk harbor works.

For 10,528 feet, lineal, of one foot square, oak and pine timber, at the average price of 18 cents per lineal foot	$1,904 40
For 10,750 feet, board measure, of plank, 3 inches thick, at $25 per M	268 75
For 21,500 pounds of one inch square wrought iron for bolts, at 4 cents per pound	860 00
For 1,200 pounds of wrought iron spikes, at 7½ cents per pound	90 00
For 150 cords of ballast stone, at $6 per cord	900 00
For superintendence, carpentry, and labor	795 00
Sum	4,818 15
Add 10 per cent. for contingencies	481 81
Amount required for repairs	5,299 96

J. D. GRAHAM,
Major U. S. Topographical Engineer Corps,
Brevet Lieutenant Colonel, Superintending Engineer.

OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

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*See page 383 of Part 2 of Senate (Ex.) Doc. No. 1, of the 34th Congress, 1st session.
† See page 188 of Part 2 of Senate (Ex.) Doc. No. 1, of the 33d Congress, 2d session.

M 2.

Estimate of the cost of one crib suitable for the breakwaters designed for the harbor of Dunkirk, New York; each crib to be 30 *feet long*, 25 *feet wide, and* 18 *feet high from the soil at bottom to the water surface, or* 23 *feet high from the bottom to the flooring at top; to be constructed in accordance with the drawings in sheet G, No.* 21, *and the specifications in table T* 3, *at pp.* 18 *to* 21 *of Senate (Ex.) Doc. No.* 16, *of the* 34*th Congress*, 3*d session:*

For 4,061 lineal feet of white oak timber, one foot square, at 18 cents per lineal foot	$730 98
For 1,728 feet, board measure, of 3 inch oak plank, for flooring, at $18 per M	31 10
For 6,537 pounds $1\frac{1}{2}$ inch round wrought iron for bolts, at 4 cents per pound	261 48
For 127 pounds of wrought iron spikes, $\frac{3}{8}$ by $\frac{3}{8}$ of an inch square, at $7\frac{1}{2}$ cents per pound	9 52
For 87 cords of hard boulder stone, at $7 per cord of 128 cubic feet	609 00
Estimated cost of materials	1,642 08
For carpenter's work in dressing timber and cutting dove-tails and gains	300 00
For putting together, floating out and filling with stone	150 00
For superintendence by local agent	150 00
	2,242 08
Add 10 per cent. for contingencies, such as pay for draughtsmen and assistants to superintending engineer, office rent, transportation, fuel and quarters of superintending engineer, stationery, &c	224 20
Estimated cost of one crib	2,466 28

J. D. GRAHAM,
Major U. S. Topographical Engineer Corps,
Brevet Lieutenant Colonel, Superintending Engineer.

OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, September, 1857.

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27. BUFFALO HARBOR, NEW YORK.

No work has been done at this harbor the present season for want of means.

A portion of the protection wall is injured, and ought to be repaired immediately.

I agree with Colonel Turnbull in recommending the rebuilding the

wall about the light-house. From its present defective condition that important structure is in danger. I also agree with him in recommending a renewal of the tow-path in a manner to correspond in character with the wall. Its condition is now very bad, even worse than it was at the time of Colonel Turnbull's last report, dated September 1, 1856, to be found in the Topographical Bureau in manuscript. It should have immediate attention, or the consequences to the harbor will be serious.

For the cost of these improvements I beg leave to refer to, and present again, the estimates given in detail by Colonel Turnbull, which will be found printed in Senate (Ex.) Doc. No. 1, of the 34th Congress, first session, part 2, at pp. 381 and 382. The same estimates were again presented by him in September, 1856, for these items, as follows, viz:

For the repair of the tow-path of the south pier.....	$18,620 85
For rebuilding the wall in front of the light-house.....	1,589 00
To this last item I must now add 50 per cent. for deterioration of the wall since.....	794 50
Also for dredging (now required) 10,850 cubic yards along the south pier and off the pier head, at 50 cents per cubic yard.....	5,425 00
And for contingencies, such as repairs of steam dredge, transportation, superintendence, &c.....	1,250 00
Total required for Buffalo harbor, New York.....	27,679 35

In view of the great importance of this work, and the preservation of the harbor in good condition, for the sake of the general lake commerce, I would most respectfully and urgently recommend that the above sum of twenty-seven thousand six hundred and seventy-nine dollars and thirty-five cents be granted in one appropriation, and at an early period.

AN ADDITIONAL STEAM DREDGE BOAT FOR LAKE ERIE.

I beg leave respectfully to recommend the immediate building of another steam dredge with six drop-bottom mud scows for Lake Erie. At present there is but one dredge boat with four mud scows on this lake. They are entirely inadequate to the performance of half the work required in aid of the harbor improvements now going on upon this lake, and often while they are at work for one harbor, others are suffering great injury for want of similar services.

Owing to the sandy nature of our lake coasts dredging is, and must always be, an essential element in the improvement and preservation of their harbors. Fortunately, experience has fully shown that this necessary operation, although in many cases it must be an habitual yearly one, is the least expensive mode of keeping these harbors open to navigation and free of dangerous shoals.

For an additional dredge boat and six mud scows for Lake Erie, and for two additional mud scows to attend the dredge boat now on this lake, I herewith present an estimate, marked N 1, amounting to.....	$19,232 00
I also present another estimate, marked N 2, for the repair of the present dredge boat on this lake, and her scows, amounting to.....	1,950 00
Total amount required on account of dredge boats and their attendant mud scows on Lake Erie.....	21,182 00

N 1.

Estimate of the cost of a steam dredge boat and eight mud scows for Lake Erie.

1. FOR THE DREDGE BOAT AND ENGINES.

Dimensions.

Length of keel.....	110 feet
Breadth of beam.....	25 "
Depth of hold.....	7½ "
Length on deck.....	125 "
Greatest breadth on deck.....	40 "

Cost of building and rigging.

Hull, 217 tons, at $35 per ton.....	$7,595 00
Windlass, capstan, chocks, &c.....	150 00
Carriage frames and wheel-houses.....	200 00
Engine room and upper cabin.....	470 00
2 engines and 2 boilers, of forty-horse power each, with cylinders of 12 inch bore and 28 inches stroke.....	3,500 00
26 dredging buckets, (13 on each side,) at $50 each.....	1,300 00
Bucket chains.....	500 00
Journals and boxes.....	150 00
2 paddle-wheels for locomotion.....	300 00
Iron castings for shafts, horn flange, and cog and driving wheels, 10,000 pounds, at 5 cents per pound.....	500 00
Chain for elevating the carriages—60 feet of half-inch chain, 500 pounds, at 10 cents.....	50 00
Six iron sheaves for the above, 60 pounds, at 10 cents per pound.....	6 00
Coal bunkers under deck for 50 tons of coal, with scuttles, iron grated, on deck.....	75 00

Twelve berths for crew	$25 00
Two large anchors, 800 pounds each, = 1,600 pounds, at $100 each anchor, 12½ cents per pound	200 00
Two small anchors, for kedging, 200 pounds each, = 400 pounds, at 12½ cents per pound	50 00
One chain cable of 70 fathoms, of ⅞ inch best wrought iron, 4,000 pounds, at 10 cents	400 00
One hemp cable, 100 fathoms long, of five inches round	100 00
Two warp lines of Manilla, three inches round, each 100 fathoms long	100 00
One writing table and six common chairs	12 00
One stove and pipe, for the cabin	20 00
One cooking stove, for use of crew	35 00
For contingencies, such as extra blacksmith's work, &c.	200 00
Estimated cost of dredge boat, engines and appurtenances	15,938 00

2. FOR SIX MUD SCOWS, TO BE ATTACHED TO THE NEW STEAM DREDGE BOAT.

Six mud scows of oak, with drop bottoms, the wells to hold 25 cubic yards, at $375 each	$2,250 00
Six elevating windlasses, with chains and cogs for working the drop bottoms of the six mud scows, at $18 each	108 00
Contingencies, such as blacksmith's work, &c.	100 00
Estimated cost of the six mud scows for the new dredge boat	2,458 00

3. FOR TWO ADDITIONAL MUD SCOWS FOR THE PRESENT STEAM DREDGE BOAT ON LAKE ERIE.

Two mud scows of oak, with drop bottoms, the wells to hold 25 cubic yards, at $375 each	$750 00
Two elevating windlasses, with chains and cogs for working the drop bottoms of the two mud scows, at $18 each	36 00
Contingencies, such as blacksmith's work, &c.	50 00
Estimated cost of two additional mud scows for the present Lake Erie steam dredge boat	836 00

Recapitulation.

1. Estimated cost of a new steam dredge boat, with machinery and appurtenances	$15,938 00
2. For six mud scows for same	2,458 00
Total for steam dredge boat and 6 mud scows complete	18,396 00

3. For two additional mud scows for the steam dredge boat, now on Lake Erie.....	$836 00
Aggregate.....	19,232 00

J. D. GRAHAM,
Major Topographical Engineer Corps,
Brevet Lt. Colonel, Sup't Engineer.

OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

No. 2.

Estimate of funds required for the repair of the United States steam dredge boat and her four scows, now on Lake Erie.

For raising, docking and mending hole in bottom.....	$500 00
For repairing and cleaning engines and boilers and buckets	180 00
For repairing inside of hull, and thoroughly caulking and launching.....	275 00
For painting outside and inside.....	150 00
For 250 yards of canvas for the upper deck, at 20 cents per yard.....	50 00
For painting same.....	12 00
For repairing two yawl boats, at $25 each.....	50 00
For two oak spuds, shod with iron, at $25 each.....	50 00
For working hawser 500 lbs. tarred rope, at 15 cents.....	75 00
For 200 lbs. Manilla warp, at 16 cents.....	32 00
For 200 lbs. tarred rope for warps for scows, at 11 cents....	22 00
For one pair double 10 inch blocks and fall.....	10 00
For one pair double 7 inch blocks and fall.....	4 00
For one mariner's compass.....	20 00
For one patent steam gauge.....	20 00
For four kedge anchors for the four scows, at $12 50.....	50 00
For new steam cocks, wrenches and tools.....	50 00
For repairing, caulking and launching four mud scows, at $75 each.....	300 00
For one coil of cable rope for four scows, say 800 lbs., at 12½ cents.....	100 00
Amount required.....	1,950 00

J. D. GRAHAM,
Major Topographical Engineer Corps,
Brevet Lt. Colonel, Sup't Engineer.

OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

IV. LAKE ONTARIO HARBOR WORKS.

28. OAK ORCHARD HARBOR, NEW YORK.

The balance of the former appropriation which remained on hand for this work when I took charge of it has been expended the present season in dredging the harbor.

The work was commenced on the 29th of July, and continued to the 16th of September, inclusive, 1857. Within that time eleven thousand one hundred and sixteen (11,116) cubic yards were excavated and removed.

When the dredging was commenced no more than five and a half feet could be carried into the harbor.

It was deepened by the operation to full eight feet through, and but for a few intervening lumps there would be nine feet. The inhabitants of this place and its vicinity, stimulated by the good effects of the dredging, raised the sum of $1,000, which was expended in continuing the operation after the balance of the United States appropriation was exhausted. The custody and direction of the United States dredge boat was continued, however, as before, by this office, and the work directed by it according to the established government rule in such cases. For full information on this point I refer to the accompanying documents, marked S 6 to S 10, under the head of Oswego harbor, and O 1 to O 12, under the present head.

The statement marked O 3 shows the number of scow loads and cubic yards that were excavated and removed each day, Sundays excepted, from the 28th of July to the 16th of September, inclusive, 1857.

There is water enough in the channel of this harbor now to enable vessels drawing eight (8) feet to enter, and a beacon-light should be erected for their benefit.

About 408 feet of the west harbor pier is in bad condition, and requires repairs.

The whole of the east pier, 735 feet long, is in a state of great decay, and ought to be immediately repaired. For these objects I herewith present an estimate, marked O 13, amounting to $9,736 65.

I would recommend the granting of this sum without delay, in order to prevent a rapid increase in the dilapidation.

The plan of the board of engineers for completing this harbor is to extend the piers out to 15 feet depth of water in Lake Ontario. This will require for the west pier an extension of 608 feet, or say 19 cribs, each 32 feet long, and for the east pier an extension of 544 feet, equal to 17 cribs of the same length, making a total of 36 cribs, each 32 feet long, 20 feet wide, and of an average height of 18 feet from the soil at bottom to the flooring at top; the average depth of water they will occupy being thirteen (13) feet.

For thus completing the piers, and for the necessary dredging, I herewith present an estimate, marked O 14, amounting to $51,761 90.

I would recommend that this sum be granted in three equal annual appropriations, each of.....	$17,253 97
To which add the amount of O 13, for repairs.....	9,736 65
Amount required for the first year's appropriation for Oak Orchard harbor, New York.....	26,990 62

O 1.

Colonel Graham to Captain William S. Malcolm.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, July 8, 1857.

SIR: Your letter of the 1st instant is this day received. Please inform me how soon do you expect to finish the dredging at Sodus bay. I would like to know somewhat in advance of the time for you to go to Oak Orchard. The employment of a tug will be left to your own judgment.

Has the dredge power enough to tow her scows to Oak Orchard with safety? I always prefer to have such trips, on our western lakes, made rather quickly, to diminish the risk of accidents from sudden storms and lake squalls, particularly as the government does not insure.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Lieut. Colonel, Superintending Engineer, &c.

Captain WILLIAM S. MALCOLM,
U. S. Steam Dredge, now at Sodus Bay,
Wayne county, New York.

O. 2.

From Captain Malcolm to Colonel Graham.

UNITED STATES DREDGE,
Mouth of Oak Orchard Creek, July 24, 1857.

SIR: I arrived here yesterday with the United States dredge and three scows, having lost one by the ring bolts all pulling out. The wind was fair and the sea high. The other three are much bruised by collision with each other in towing, and we had much difficulty in saving them.

There is no wood here, except that which can be obtained from the farmers, and I have made arrangements with several parties to have it delivered next week.

The water here is quite shoal, and we can only dredge when it is very smooth.

The nearest village or post office is called Carlton, a mile from here, to which place you will please address your letters to me.

Rochester is next harbor to this, thirty-six miles distant.

A tug, in coming here, would have been of no service, as she could not have entered the creek for want of water, and the sea breaks all the way across the mouth.

I am, very respectfully, sir, your obedient servant,

WM. S. MALCOLM,
Carlton, Orleans county, New York.

Colonel J. D. GRAHAM,
General Superintending Engineer
of Lake Harbor Works, Chicago.

O 3.

*Statement of the number of scow loads and cubic yards of earth excavated and removed from the entrance and harbor of Oak Orchard creek, State of New York, by the United States steam-dredge for Lake Ontario, between July 28 and September 16, 1857.**

Date.	Remarks, incidents, &c.	Scow loads.	Cubic yds.
1857.			
July 28	Wind SW.; rain	9	220
29	Wind N.; light and clear weather	15	366
30	Wind SE.; clear	9	220
31	Wind SE.; clear a. m., rain p. m	13	317
Aug. 1	Wind strong from the W	17½	427
3	Fine pleasant weather	17½	427
4	Sea too high to operate; N. wind	----------	----------
5	Fine weather	17	415
6	Wind SW. a. m., NE. p. m	10	244
7	Wind S. a. m, NE. p. m.; took out a tree 30 ft. long	10	244
8	Wind SW.; clear and warm	19½	476
10	Wooded a. m.; light air	10	244
11	Too much sea to operate	----------	----------
12	S. wind; rain p. m	22	537
13	Strong gales; too much sea to operate	2	49
14	Wind WSW.; strong rain p. m	13	317
15	Wind W., with a sea; cloudy	10	244
17	Too much sea to operate	----------	----------
18	Heavy swell from NW	9	220
19	Wooded a. m.; wind NE	13½	329
20	Wind W, with a sea	8	195
21	Wind NE	13	317
22	Wind NE.; rain	14⅔	358
24	Strong gales from the NW.; too much sea to operate	----------	----------
25	Fine weather	13½	329
26	------do	14½	354
27	------do	16¾	407
28	------do	15	366
29	------do	20	488
31	Wooded this day	----------	----------
Sept. 1	Fine weather	9	220
2	Calm and fine weather	10	244
3	Wind S.; weather pleasant	16	390
4	Light wind from NE	12	293
5	Wind SW., strong.; too much sea to operate	8	195
7	Strong gale from NE.; cannot operate	----------	----------
8	Light wind from SE	6	146
9	Very pleasant	16½	403
10	------do	6⅔	163
11	------do	18	439
13	Sunday	----------	----------
14	Wind S. all this day; pleasant	17	415
15	Wind W.; too much sea to operate	----------	----------
16	Wind NE.; some sea	4	98
17	Started for Oswego in tow of steam-tug Morgan	----------	----------
	Total number of loads and yards excavated	455½	11,116

* Each scow load is equal to 24$\frac{4}{10}$ cubic yards.

J. D. GRAHAM,
Major Corps Top. Eng'rs, Bvt. Lieut. Colonel, Sup'g Engineer.

OFFICE GENERAL SUPERINTENDENCE LAKE HARBOR WORKS,
Chicago, September 30, 1857.

O 4.

Captain Malcolm to Colonel Graham.

CARLTON, ORLEANS COUNLY,
Oak Orchard Harbor, July 31, 1857.

SIR: We commenced operating here on the 28th instant, and are making fine progress with this work.

I have received no communication from you since the 13th instant, ordering the dredge to this harbor.

The inhabitants of this vicinity propose and will raise a few hundred dollars to aid in the expense of deepening this channel; and if it meets your appprobation, I will remain to work out their money.

I am, very respectfully, sir, your obedient servant,

WILLIAM S. MALCOLM,
Captain of Steam Dredge Boat.

Colonel J. D. GRAHAM,
General Superintending Engineer of Lake Harbor Works, Chicago.

O 5.

Captain Malcolm to Colonel Graham.

CARLTON, ORLEANS COUNTY,
Oak Orchard Harbor, August 5, 1857.

SIR: Our progress has given much satisfaction to the inhabitants of this vicinity; so much so, that they have held a public meeting here for the purpose of raising funds to defray the expense of deepening the channel between the piers; and I have been requested by them to apply to you for the use of the dredge, after the government funds shall have been expended, to work out whatever amount they may raise. It will probably amount to $1,000.

I have recovered the scow which went ashore near here, and shall haul it out and repair it.

Previous to leaving Sodus Point I sent you all the accounts made against the dredge to the 21st of July, which I trust you found correct.

I will be much obliged to you for more blank vouchers.

I am, very respectfully, sir, your obedient servant,

WILLIAM S. MALCOLM,
Captain of Steam Dredge Boat.

Colonel J. D. GRAHAM,
General Superintending Engineer of Lake Harbor Works, Chicago.

O 6.

Captain Malcolm to Colonel Graham.

CARLTON, ORLEANS COUNTY,
Oak Orchard Harbor, August 17, 1857.

SIR: You will please receive enclosed the voucher of Erastus Rogers for work at Sodus Point. I trust you have received all the vouchers for accounts made against the dredge to the 21st of July.

The inhabitants in this vicinity have raised one thousand dollars, ($1,000,) to be expended under your direction in deepening the channel to this harbor; and they hope that their application to you, to have the dredge work out this fund, will meet your approval, and they are now awaiting with much interest a favorable response.

Our work progresses as favorably as could be desired. In operating in the gravel, we raise from 500 to 600 yards per day; in the clay and stone, from 300 to 400 yards per day.

The lake winds come up so suddenly now that it will not be prudent to attempt to get to Oswego without a tug, and the expense will probably be one hundred and fifty dollars ($150.)

I am, very respectfully, sir, your obedient servant,

WILLIAM S. MALCOLM,
Captain of Steam Dredge Boat.

Colonel J. D. GRAHAM,
General Superintending Engineer
of Lake Harbor Works, Chicago.

O 7.

Colonel Graham to Captain William S. Malcolm.

OFFICE GENERAL SUPERINTENCE, &C.,
Chicago, August 18, 1857.

SIR: I am very glad the inhabitants of Oak Orchard harbor and its vicinity have determined to contribute a sum of money for continuing the dredging of that harbor. You are authorized to continue the dredging of it as long as you can work the present season, provided they keep you supplied with ten days' *advance of funds*, to cover your own pay, the pay of the engineer, foreman, and all the crew, and all expense of working the dredge, including fuel, oil, and all repairs to keep the dredge and her scows in good working order, under your direction, acting under the orders of this office. On no other conditions am I authorized to assent to their proposition; and, in case the inhabitants comply with this rule, you will have it distinctly understood by them, the crew of the vessel, and all persons with whom you deal, that neither the United States, nor the dredge boat, nor the scows, nor their appurtenances, are responsible or liable

for any expense of continuing the dredging, after the amount of United States funds, above mentioned, shall be exhausted; but that the said inhabitants are solely liable and responsible after that period. I am compelled, by the rigid rule of the department, to enter here into these particulars.

On the first failure to keep you thus in advance with funds to meet ten days' full expenses, you will proceed with the dredge boat and her scows to Oswego, to lay up for the winter. But if the said advance of funds is kept steadily up without any omission, you can continue the dredging to the end of the present season; and, indeed, in that case I shall be disposed to reward the laudable enterprise of the inhabitants by allowing the dredge to be laid up the coming winter at Oak Orchard, provided there is a safe place for mooring her where she will not be injured by ice or storms.

You will please give me an immediate answer on this point, it being understood that no one is, in any case, to interfere with your control and management of the dredge and her scows, under the direction of this office, and also that the dredging is to be done for the improvement of the best channel, in accordance with the plan which has been approved by the War Department.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Lieutenant Colonel, Superintending Engineer.

Capt. WM. S. MALCOLM,
United States Steam Dredge, Oak Orchard Harbor, N. Y.

O 8.

Colonel Graham to Captatn Wm. S. Malcolm.

OFFICE GENERAL SUPERINTENDENCE, &C.,
Chicago, August 21, 1857.

SIR: You have probably by this time received my letter of the 18th instant, with remittances of funds.

I am much pleased to learn, by your letter of the 17th instant, that the inhabitants of Oak Orchard Creek and its vicinity have already raised the sum of $1,000 to be expended, under the direction of this office, in continuing the dredging of that harbor.

I approve, under these circumstances, of your going on with the dredging to the extent of the additional means thus furnished, to be done under the instructions forwarded to you in writing on the 18th instant.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Lieutenant Colonel, &c.

Captain WM. S. MALCOLM,
United States Steam Dredge, Oak Orchard Creek.

O 9.

Captain Malcolm to Colonel Graham.

CARLTON, ORLEANS COUNTY, N. Y.,
U. S. Dredge, Oak Orchard Harbor, Aug. 21, 1857.

SIR: I have the honor to acknowledge the receipt of your letter of the 18th instant, with its contents and blank vouchers. In my letter of the 17th instant (if it has come to hand) I had the honor to inform you that the citizens in this vicinity had raised one thousand dollars to continue the dredging of the channel of this harbor under your orders and directions.

Your order, granting the use of the dredge on the conditions mentioned in your letter, meets with general satisfaction.

I will foward to you all the vouchers necessary to close the account of this harbor as soon as possible.

We are making fine progress with our work; the dredge and scows are all in good condition, and the expenses in repairs of the same have been trifling.

The nearest store and town is Albion, a distance of nine miles from this.

The citizens here are so much elated at the idea and prospect of having their harbor improved, that they are making application to the Light-house Board for a beacon-light.

I am, very respectfully, sir, your obedient servant,

WM. S. MALCOLM,
Captain U S. Steam Dredge.

Col. J. D. GRAHAM,
Sup. Eng. of Lake Harbor Works, Chicago.

O 10.

Colonel Graham to Captain Wm. S. Malcolm.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, August 27, 1857.

SIR: Have you measured the capacity of your wells or holds of your scows? If so, let me know how many cubic yards you calculate each one to hold. Let me know how many feet you make the length, and how many feet the breadth of the hold at top; also the same at bottom; also the perpendicular depth. Then I can compute the contents of each one.

I wish you to report what depth of water could be carried in over the bar and into the harbor of Sodus Bay, when you ceased dredging. State, as near as you can, what width of channel carried ten feet, and also what width carried twelve feet or more.

I shall want a similar statement in regard to Oak Orchard at the end of the working season.

Please inform me at once if the dredge boat and her scows can be safely laid up and moored at Oak Orchard harbor for the coming winter, so as to make her secure against injury from ice and storms.

I am much pleased that you are progressing so well with the dredging, and that you are careful to keep everything in a state of good repair. That is a very important matter.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Lieutenant Colonel, &c., &c.

Captain WILLIAM S. MALCOLM,
U. S. Steam Dredge, Oak Orchard Harbor.

O 11.

Captain Malcolm to Colonel Graham.

OAK ORCHARD HARBOR,
Carlton, Orleans County, September 2, 1857.

SIR: In relation to the laying up of the United States dredge at this place, I do not consider it a safe place. In the spring the current is strong; there is no dock of any kind that she can be moored to, and I would not lay up one of my own here. When at Oswego, I found that the lowest price she could be towed to Oswego for was $130; and I intend, if possible, to save enough from the funds of the inhabitants to take her to Oswego, and have told these persons so here. I expect to leave here about the 20th inst., unless otherwise ordered by you, as after that time the weather will become too stormy to operate to advantage, or to be safe for the scows and dredge.

While at Oswego, one of the directors of the Little Sodus and Auburn railroad informed me that the company had made application to the War Department for the dredge to operate at that place.

She can operate to better advantage there, for the reason that the gravel can be deposited in the bay when the lake is rough.

In relation to the number of yards that the scows hold, I will send their dimensions to-morrow, together with more vouchers.

I am, very respectfully, sir, your obedient servant,

WILLIAM S. MALCOLM,
Captain of Steam Dredge Boat.

Colonel J. D. GRAHAM,
Sup'g Engineer of Lake Harbor Works, Chicago

O 12.

Captain Malcolm to Colonel Graham.

U. S. DREDGE, OAK ORCHARD HARBOR,
Carlton, Orleans County, New York, September 3, 1857.

SIR: I have measured the scows under your orders of the 27th of August. They are as follows, viz: Well or box, length at top, $21\frac{10}{12}$ feet; well or box, length at bottom, $21\frac{10}{12}$ feet; well or box, width at top, 9 feet; well or box, width at bottom, $2\frac{6}{12}$ feet; well or box, perpendicular, $5\frac{3}{12}$ feet; whole length of the scows, 40 feet; extreme width of the scows, $13\frac{2}{12}$ feet.

You will please receive enclosed two plans of the harbor of Big Sodus. It was my intention to have operated entirely on the centre of the channel, but the quicksand prevented. The piers, there, are 470 feet apart.

By the 1st of November it will be found difficult to carry in the channel of Big Sodus a greater draught than $9\frac{1}{2}$ feet of 250 wide, as the water of Lake Ontario is unusually high now, and will fall over two feet.

I shall be more particular with the soundings of this harbor, and measure with a line stretched from "pier to pier."

An arrangement has been made with the committee of the citizens who raised the $1,000 that money enough is to be held in my hands to defray the expense of taking the dredge to Oswego or Little Sodus, as you shall deem most proper. She would be wintered or laid up more safely at Little Sodus than at Oswego, and there could be no danger from fire or freshet in the spring.

This fund will probably be exhausted by the 20th, when I shall telegraph to Oswego for a tug, unless otherwise directed by you.

You will please receive enclosed the vouchers of Jefferson Edmonds for wood, and of J. Murray & Sons for iron, &c. You will observe that nothing is charged to the United States fund after the date of your order of the 18th of August, giving the use of the dredge to the citizens.

I shall endeavor to put the scows and dredge in good order before leaving here. Trusting what has been accomplished will meet your approbation,

I am, very respectfully, sir, your obedient servant,

WM. S. MALCOLM,
Captain Steam Dredge Boat.

Colonel J. D. GRAHAM,
General Superintending Engineer of
Lake Harbor Works, Chicago.

O 13.

Estimate of the cost of repairing the piers at Oak Orchard harbor, New York.

For 26,052 lineal feet of pine timber, hewn one foot square, at 14 cents per lineal foot	$3,647 28
For 53,352 feet, board measure, of pine plank, three inches thick, at $12 per thousand	640 22
For 21,294 pounds of one-inch square wrought iron, for bolts, at 4 cents per pound	851 76
For 4,925 pounds of wrought iron spikes, $\frac{3}{8}$ by $\frac{3}{8}$ of an inch square, pointed and headed, $7\frac{1}{2}$ cents per pound	369 37
For 320 cords of stone, for crib ballast, at $3 50 per cord	1,120 00
	6,638 63
For superintendence, carpentry, and labor	2,212 87
Sum	8,851 50
Add 10 per cent. for contingencies	885 15
Amount required for immediate repairs of Oak Orchard harbor	9,736 65

J. D. GRAHAM,
Maj. Corps Top. Eng., Bvt. Lieut. Col. Sup. Eng.
OFFICE GEN. SUP. OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

O 14.

Estimate of the cost of completing Oak Orchard harbor, New York, in accordance with the plan of the Board of Engineers.

1. FOR THE PIER EXTENSIONS.

In order to reach 15 feet of water in the lake, the west pier must be extended 608 feet, and the east pier 544 feet.

The average depth occupied by these piers will be 13 feet.

There will, therefore, be required for the west pier 19 cribs, and for the east pier 17 cribs—total, 36 cribs—each 32 feet long, 20 feet wide, and 18 feet high from the soil at bottom to the flooring at top, and 13 feet high from the bottom to the water level. It is recommended that these cribs be constructed in accordance with the drawings in sheet marked G, No. 20, now in the Topographical Bure au, and the specifications contained in table T 2, at pp. 16 to 18 of Senate (Ex. Doc.) No. 16, of the 34th Congress, 3d session.

Cost of one crib.

The estimate will then be as follows, viz:

For 2,117 lineal feet of pine timber, hewn 1 foot square, at 14 cents per lineal foot	$296 38
For 880 lineal feet of white oak timber, hewn 1 foot square, at 16 cents per lineal foot	140 80
For 1,482 feet, board measure, of white oak plank, for flooring, 3 inches thick, at $18 per thousand	26 68
For 2,829 pounds of 1-inch square wrought iron, for bolts, at 4 cents per pound	113 16
For 137 pounds of wrought iron spikes, $\frac{3}{8}$ by $\frac{3}{8}$ of an inch square, at $7\frac{1}{2}$ cents per pound	10 28
For $56\frac{1}{2}$ cords of stone, at $3 50 per cord	197 75
Estimated cost of materials for one crib	785 05
For superintendence, carpentry, and labor	400 00
Sum	1,185 05
Add 10 per cent. for contingencies	118 50
Estimated cost of one crib	1,303 55
Then, 36 cribs, at $1,303 55 each, give for the extending of both piers	46,927 80

2. FOR THE DREDGING.

This will require, to produce a depth not less than twelve (12) feet between the piers now existing and between the proposed pier extensions as far out as twelve (12) feet water in Lake Ontario, the excavation and removal of the following quantity of earth, viz:

Between the present piers 27,970 cubic yards, at 12 cents per cubic yard	$3,356 40
Between the proposed pier extensions, 10,555 cubic yards, at 14 cents per cubic yard	1,477 70
(2.) Amount required for the dredging	4,834 10

RECAPITULATION.

(1.) For the pier extensions	$46,927 80
(2.) For dredging	4,834 10
Total for completing Oak Orchard harbor	$51,761 90

J. D. GRAHAM,
Maj. Corps Top. Eng., Bvt. Lieut. Col. Sup'g Eng.

OFFICE GEN. SUP. OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

29. GENESEE RIVER HARBOR, NEW YORK.

This harbor is at the mouth of Genesee river. It is sometimes called Charlotte harbor. The last appropriation made by Congress for it was twenty thousand dollars ($20,000) in 1852. It was nearly all expended the following year, under the direction of Colonel Turnbull, in repairing the west pier, which is 1,943 feet long.

The east pier, 2,034 feet long, was reported by Col. Turnbull, as long ago as September, 1853, to be in a much decayed condition, and an appropriation of $21,530 was recommended by him for its repair, but it was never granted. It must now be entirely rebuilt from two feet below the water level to five feet above. There are also portions that are dilapidated to a great depth below the water surface, and, as Col. Turnbull justly states, in his two last annual reports, "in moderate gales of wind it is entirely submerged, which renders the approach of vessels to the entrance of the river very dangerous."

For this object, including the tearing away and removal of the decayed portion, I herewith present an estimate marked P, amounting to $41,084 34.

I would recommend, in order to prevent the ruin of the harbor, that this appropriation be immediately granted in one appropriation.

P.

Estimate of the cost of repairing the east pier of Genesee river harbor, by tearing away the old work to two feet below the water level, and then building up to five feet above the water level.

For 76,288 lineal feet of oak timber, hewn 1 foot square, at 18 cents per lineal foot	$13,731	84
For 95,488 feet, board measure, of white oak plank, 3 inches thick and 8 inches wide, in pieces 20 feet long, at $18 per M	1,718	78
For 67,392 pounds of wrought iron, 1 inch square, for bolts, at 4 cents	2,695	68
For 8,768 pounds of wrought iron spikes, $\frac{3}{8}$ by $\frac{3}{8}$ of an inch square, at $7\frac{1}{2}$ cents per pound	657	60
For 1,376 cords of ballast stone, at $3 50 per cord	4,816	00
Cost of materials	23,619	90
For superintendence, carpentry, and labor, at $120 per 32 feet lineal	7,627	50
Cost of new work	31,247	40

Brought forward.....	$31,247 40
For tearing away and removing materials of the old decayed work, 2,034 lineal feet, at $3 per lineal foot.....	6,102 00
Sum.....	37,349 40
Add 10 per cent. for contingencies.....	3,734 94
Amount required.....	41,084 34

J. D. GRAHAM,
Maj. Top. Eng. Corps, Bvt. Lieut. Col. Sup. Eng.

OFFICE OF GEN. SUP. OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

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30. SODUS BAY HARBOR, WAYNE COUNTY, NEW YORK.

There has been no appropriation for this harbor since that granted in 1852, which amounted to the sum of ten thousand dollars, ($10,000.) This was entirely inadequate to the repairs of the piers then needed. It was nearly all expended in 1853, under the direction of Colonel Turnbull, in repairing the east channel pier, and a part of the east harbor pier.

The remainder of the east harbor pier, and also the entire west pier from the beacon-light to the beach, is entirely rotten, and both must be rebuilt from two feet below the water level to five feet above that level.

Unfortunately these repairs have, for want of means, been so long put off that the beacon-light must be overthrown by the failing of the timbers in the first severe storm that shall occur.*

For these repairs and for dredging I herewith submit an estimate, marked Q 1, amounting to the sum of $40,806.

I recommend that it be granted in one appropriation, in order to save the harbor from ruin.

I cannot better present the importance of this harbor than by the following extract from the last annual report of Colonel Turnbull, dated September 1, 1856, which is in the Topographical Bureau, in manuscript. He says:

"The Sodus Point and Southern Railroad Company, organized in 1852 under the general railroad law of the State of New York, propose to construct a railroad on the broad gauge, from Great Sodus Bay, on Lake Ontario, by the shortest route practicable, to form a connexion—through a portion of the Canandaigua and Elmira railroad—with the New York and Erie railroad, at the village of Elmira. This road is already begun, and only about thirty-five (35) miles of road remain to be built to effect this connexion.

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*P. S. This has happened since the above was written.

"This road, when completed, will no doubt attract a good proportion of trade to this bay, which is peculiarly well adapted to accommodate it in regard to space, depth of water, facilities for wharfing, and perfect security in storms. As a harbor of refuge, it is of great importance to the commerce of the lakes."

There is a coast light on the west bank at the entrance to this bay.

The small balance of the last appropriation was expended under the direction of this office the present season in dredging this harbor.

The work was commenced on the 25th of June, and continued to include the 20th of July, 1857. Within that time there were nineteen (19) working days, and there were excavated and removed from the channel six thousand two hundred and thirty-three (6,233) cubic yards.

Each day's work is given in the accompanying paper, marked Q 4. For general information, please refer to the papers marked from Q 1 to Q 9. The actual expense of this dredging (exclusive of the sum of $164 44 expended in repairing the dredge boat and scows at Oswego) was as follows, viz:

Accounts in second and third quarters of 1857.

Voucher.	To whom paid.	On what account.	Amount.
	Accounts 2d quarter 1857.		
1	A. H. Burley	Stationery	$1 99
5	A. H. Burley	Stationery and postage stamps	6 65
7	Sheboygan harbor	Stationery	5 50
8	Sheahan & Cameron	Blank forms	9 00
	Accounts 3d quarter 1857.		
1	P. P. Wright	Towing	47 00
2	Miller, Ketts & Moore	Wood, &c.	46 21
3	Erastus Rogers	Services and iron	11 80
4	W. S. Malcolm	Wood for fuel	141 37
5	W. S Malcolm	Services as captain of steam-dredge	67 74
6	Pay-roll	Services of crew	292 46
7	Chicago post office	Postage stamps	90
9	Chicago Gas and Coke Co.	Gas light for office of superint'g engineer.	2 63
10	E. Williams	Provisions for crew	62 27
		Cost of dredging 6,233 cubic yards	695 52

The cost per cubic yard of this dredging was, therefore, 11.16 cents—that is to say, eleven cents and $\frac{16}{100}$ per cubic yard; and the average quantity excavated and removed per day was three hundred and twenty-eight cubic yards—that is to say, 328 cubic yards per day.

When the dredging was commenced, not more than ten (10) feet could be carried through the channel. When it ended for the season, on the 20th of July, 1857, twelve (12) feet could be carried through the whole width for one-third the distance up the channel, and for half the width (the west half) the remaining distance. This was of

great advantage to navigation, as it enabled vessels bound coastwise to take refuge here in some of the violent autumnal gales.

The completion of the dredging necessary to give full twelve (12) feet depth entirely between the channel piers should by all means be effected next season.

Q. 1.

Estimate of the cost of repairing the piers of Sodus Bay harbor, Wayne county, New York, and of dredging, to complete the depth of twelve feet entirely, between the channel piers.

For 73,904 lineal feet of white oak timber, hewn one foot square, at 18 cents per lineal foot.....	$13,302 72
For 91,884 feet, board measure, of white oak plank, 3 inches thick, in pieces 8 inches wide, and 20 feet long, at $18 per M.....	1,653 91
For 65,267 pounds of 1-inch square wrought iron, for bolts, at 4 cents per pound.....	2,610 68
For 8,482 pounds of wrought iron spikes, $\frac{3}{8}$ by $\frac{3}{8}$ of an inch square, at 7$\frac{1}{2}$ cents per pound.....	636 15
For 1,235 cords of ballast stone, at $3 50 per cord.....	4,322 50
Estimated cost of materials.....	22,525 96
For superintendence, carpentry, and labor, at $120 per 32 feet lineal.....	7,440 00
Estimated cost of new work.....	29,965 96
For tearing away old work to two feet below the water level, and removing the materials, 1,984 lineal feet, at $3 per lineal foot.....	5,952 00
Sum.....	35,917 96
Add 10 per cent. for contingencies.....	3,591 79
Amount required on account of piers.....	39,509 75
For dredging between the channel piers to produce 12 feet depth of water throughout this channel, 10,370 cubic yards, at 12$\frac{1}{2}$ cents per cubic yard.....	1,296 25
Total required for Sodus Bay harbor, Wayne county, New York.....	40,806 00

J. D. GRAHAM,
Major Corps of Top. Eng., Brevet Lieut. Col. Supt'g Eng.

OFFICE GEN. SUP. OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

Q. 2.

Colonel Graham to William S. Malcolm, captain of United States steam-dredge.

OFFICE GENERAL SUPERINTENDENCE, &c.
Chicago, June 16, 1857.

SIR: The United States steam-dredge for lake Ontario has been applied for by the inhabitants to dredge the harbors of Sodus Bay, (Wayne county,) and Oak Orchard creek. The authorities of Oswego having declined her use for the present; under the rules laid down by the War Department, the dredge will be employed under your direction in dredging:

First, at the harbor of Sodus Bay, Wayne county.

Second, at the harbor of Oak Orchard creek.

The expenses of putting her in order and preparing her for work will be charged equally to the appropriations for improving these two harbors. The current expenses, while she is actually employed, will be charged to the appropriation for the harbor for which she is actually working.

You will please, therefore, as captain of the dredge, repair, with her and her scows properly manned and equipped, to Sodus Bay, in Wayne county, New York, and proceed to dredge out the entrance to that harbor in conformity to the approved plan, with which you are no doubt acquainted. Should you think it necessary to employ a towing steam vessel for the scows, or for both dredge and her scows, you are authorized to do so. It is what I am obliged to do on this lake when the dredge and scows have to be moved a considerable distance, in order to insure their safety. You will please ascertain accurately the cubic contents of the scows, and keep an account, in a note book, of the number of scow loads (and hence of the number of cubic yards) excavated and removed each day. Also, an account of the weather, with reference to its suitableness for dredging. In this way we shall be enabled to state accurately the expense per cubic yard of the dredging.

Your pay and emoluments as captain of the dredge will be as heretofore, when similarly employed. The rate of pay you propose for a competent engineer, in your letter of the 20th ultimo, viz, sixty dollars ($60) per month, is approved, to commence from the time of his active employment as such; as is also that of the mate, or foreman, at thirty dollars ($30) per month.

I herewith enclose to your order a draft, on the United States assistant treasurer at New York, for four hundred dollars, ($400,) to defray the expenses of the dredging I will send to you, by to-morrow's newspaper mail, a roll of blank vouchers and pay-rolls.

Please inform me does your letter of appointment specify your full pay, when employed as agent, to be four dollars per day, or does it say $120 per month? Whichever is expressed, must govern the expressed rate in stating your pay accounts.

Your two packages of accounts have been received, but I have not had time yet to examine them. I will do so at the end of this month.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Lieut. Col. Superintending Engineer.

WILLIAM S. MALCOMB, Esq.,
Captain United States Steam Dredge,
Oswego, New York.

P. S. You are authorized to employ a man to perform the duty of "watchman of the public piers and property" at Oswego, and to attend to the observations which have been kept by you there.

His employment will be continued during your absence from Oswego. The observations should be reported to this office with your annual report.

J. D. GRAHAM, *Lieut. Col., &c.*

Q 3.

William S. Malcolm, captain United States dredge boat, to Colonel Graham.

SODUS POINT, WAYNE COUNTY,
June 24, 1857.

SIR: I have the honor to inform you of my safe arrival at this place this afternoon with the United States dredge and scows, in tow of a steam tug, and shall commence operations in the channel of this harbor to-morrow, in compliance with your orders of the 16th instant.

I am, very respectfully sir, your obedient servant,

WILLIAM S. MALCOLM,
Captain United States Dredge Boat.

Colonel J. D. GRAHAM,
General Superintending Engineer
of Lake Harbor Works, Chicago.

Q 4.

Statement of the number of scow loads and cubic yards of earth excavated and removed from the entrance and harbor of Sodus Bay, Wayne county, New York, by the United States steam-dredge for Lake Ontario, between the 25th of June and the 20th of July, 1857.

Date.	Remarks, incidents, &c.	Scow loads.	Cubic yards.
1857.			
June 25	Fine weather, strong winds	8	195
26	Fine weather, pleasant winds	17	415
27	Wooding all day	.....	.....
29	Raining all day, wind east	$16\frac{2}{3}$	407
30	Wind, west, strong ; rain p. m	$16\frac{1}{3}$	399
July 1	Strong winds from the west ; rain	13	317
2	East wind ; cloudy	$17\frac{1}{2}$	427
3	West wind ; pleasant	16	390
6	South wind ; air pleasant ; rain p. m	16	390
7	West wind ; rain p. m	10	244
8	Light air, very pleasant	14	342
9	Northeast wind, very warm	11	268
10	South wind, very pleasant	15	366
11	Wooding all day	.....	.....
13	Light air and warm weather	16	390
14	Northeast wind and warm weather	12	293
15	Light air and warm weather	13	317
16	Lost overboard one of the dredging wheels	5	122
17	Southeast wind, very warm	11	268
18	Calm weather	13	317
20	Light winds, weather pleasant	15	366
21	Making ready to leave for Oak Orchard harbor	.....	.....
	Total number of loads and yards axcavated	$255\frac{1}{2}$	6,233

NOTE.—The wells of the scows hold, each, $24\frac{4}{10}$ cubic yards.

J. D. GRAHAM,
Major Corps of Top. Engineers,
Brevet. Lieut. Colonel, Superintending Engineer.

Q. 5.

W. S. Malcolm, captain United States dredge boat, to Colonel Graham.

SODUS POINT, *July* 1, 1857.

SIR: Enclosed you will please receive a plan of this harbor. As the water is very deep, I have ordered the necessary castings to lengthen

out our chain to 14 feet, which will enable us to dig to better advantage; they will cost about $5, and I expect them to-morrow.

We average now about 350 to 400 yards per day. The west pier requires to be rebuilt to the water level; 200 of the covering plank are gone.

The east channel pier is in tolerable good order. That portion of the harbor pier running east is washed away in several places.

Is it your wish that I should employ a tug to take the dredge to Oak Orchard after leaving here? The expense will be about $150. Unless otherwise advised, I shall go without it. In your letter of the 16th of June (and I have had none since) you ask, does my letter of appointment allow me $120 per month, or $4 per day? I was appointed by Col. Turnbull captain of the dredge in 1854. In 1855, on the resignation of Mr. Hatch, I was substituted in his stead, and when employed upon the pier I received $4 per day, but I never had any letter of appointment from the department. In making up the account for the repair of the pier in May, I charged nothing for my services to it, but simply my $100 a month as captain of the dredge.

At the end of this month I will furnish a record of the weather, and the number of yards raised daily.

I am, very respectfully, sir, your obedient servant,

WM. S. MALCOLM,
Captain United States Dredge Boat.

Colonel J. D. GRAHAM,
Gen. Supt'g Eng'r of Lake Harbor Works, Chicago.

Q 6.

From William S. Malcolm, captain United States dredge boat, to Col. Graham.

SODUS POINT, *July* 7, 1857.

SIR: Will you please inform me of the amount of the appropriation at this and at Oak Orchard. My recollection is, that they are about $1,200 each; if so, I shall be obliged to leave here about the 1st of August for Oak Orchard, and would like to get there without a tug; and I think I can do so, as the expense of employing a tug will make a great inroad into the appropriation.

I have sent our boat to-day to Little Sodus, 14 miles, where I have a large anchor, of 1,050 lbs. weight, with a chain in proportion, which I shall take with me to Oak Orchard, to use in case I should have to anchor in going up. There are no tugs to be obtained short of Oswego, 30 miles distant, and they charge $5 per hour.

At the end of this month I shall require funds to pay my bills here, and will be obliged to you for them. I have received your printed report made upon the St. Clair flats, and have perused it with much satisfaction. It must have cost you a vast amount of labor.

The mail to this place is tri-weekly. Your communication of the

24th was received last night. The water in the lake still continues to rise, and owing to its great depth in the channel we are not raising as much sand and gravel as I could wish, although we discharge daily from 300 to 400 yards.

I am, very respectfully, sir, your obedient servant,

WM. S. MALCOLM,
Captain United States Dredge Boat.

Colonel J. D. GRAHAM,
Gen. Supt'g Eng'r of Lake Harbor Works, Chicago.

Q 7.

Colonel Graham to Captain Wm. S. Malcolm.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, July 8, 1857.

SIR: Your letter of the 1st instant is this day received. Please inform me how soon do you expect to finish the dredging at Sodus bay. I would like to know somewhat in advance of the time for you to go to Oak Orchard. The employment of a tug will be left to your own judgment.

Has the dredge power enough to tow her scows to Oak Orchard with safety?

I always prefer to have such trips on our western lakes made rather quickly, to diminish the risk of accidents from sudden storms and lake squalls, particularly as the government does not insure.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Brevet Lieut. Col., Sup. Engineer.

Captain WM. S. MALCOLM,
U. S. Steam-dredge, Sodus Bay, Wayne county, N. Y.

Q 8.

Colonel Graham to Captain Wm. S. Malcolm.

OFFICE GENERAL SUPERINTENDENCE, &C.,
Chicago, July 13, 1857.

SIR: When your expenses in dredging for Sodus bay, Wayne county, New York, shall have brought the vouchers which you shall have to render to me to amount to six hundred and fifty dollars ($650,) including your own pay, the fund for that harbor will be exhausted, and you will then proceed to dredge at Oak Orchard harbor.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Brevet Lieut. Col., Sup. Engineer.

Captain WM. S. MALCOLM,
U. S. Steam-dredge Boat, Sodus Bay, Wayne county, N. Y.

Q 9.

Captain Wm. S. Malcolm to Colonel Graham.

U. S. DREDGE, SODUS POINT,
July 14, 1857.

SIR: I have the honor to acknowledge the receipt of your letter of the 8th instant. Without being otherwise ordered, I shall leave here on the 1st of August for Oak Orchard.

I do dot think it necessary at this season of the year to employ a tug to take us there. In calm weather the dredge boat will make four miles an hour with her scows. She has been to Little Sodus, from Oswego, in former years, three times with her scows, and each time she had forty cords of wood *on her* and the *scows*.

Since I last wrote you I have taken from one of my vessels, laid up, a large anchor and chain, which will give us additional security, without being to any cost on the part of the government.

We find here much quicksand, and a large portion of it runs out of the buckets and scows. The chains have been lengthened out to 14 feet, at an expense of $12. The average depth of the channel is now increased to about 11½ feet, and she raises, as usual, from 300 to 400 yards per day.

I have placed a water register on this pier as a guide to future measurements. It is now $3\frac{8}{10}$ feet above low water mark.

I am, very respectfully, sir, your obedient servant,

WM. S. MALCOLM,
Captain U. S. Dredge Boat.

Colonel J. D. GRAHAM,
General Sup. Engineer of Lake Harbor Works, Chicago.

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31. SODUS BAY HARBOR, CAYUGA COUNTY, NEW YORK.

The only appropriation for this work was ten thousand dollars ($10,000) in 1852. The work was commenced in the year 1854, and with the appropriation then available, two hundred and forty feet (240 feet) in length of the west pier was built, and a deposit of stone was made to connect it with the west shore of the bay, in order to the formation of a beach. It has had a good effect. A channel eight feet deep was also excavated between the lake and the bay. Since that period no further work has been done, owing to the want of means.

To complete this harbor, by extending the piers to twelve feet water in Lake Ontario, will require an addition to the west pier of 608 feet, and the construction of an east pier 832 feet long. This will require 19 cribs for the west pier and 26 cribs for the east pier. Total, 45 cribs, each 32 feet long, 20 feet wide, and ten (10) feet average height from the bottom to the water level, or 15 feet average

height from the soil at bottom to the flooring at top. For this quantity of work, to be done in accordance with the drawings in sheet G, No. 20, now in the Topographical Bureau, and also in the archives of the United States Senate, and the specifications contained in the table marked T 2, (pp. 16 to 18 Senate (Ex.) Doc. No. 16, of the 34th Congress, 3d session,) and for dredging, I herewith present an estimate, marked R 1, amounting to the sum of $52,602 18.

I would recommend that this amount be divided into two equal annual appropriations, each of $26,301 09.

This place is fifteen miles to the west from Oswego. The bay is one and a half mile long from north to south, by an average width of about three hundred yards, and it is from 30 to 45 feet deep; consequently, if a good and safe entrance were secured to it at this point, it would make one of the best harbors of refuge practicable to be secured on the lakes. The terminus of the "Lake Ontario, Auburn and New York railroad" is on this bay, and the company contemplate pushing this work forward to completion. When this shall be accomplished, the commerce and navigation of this place must be very great, provided the piers be constructed to keep the entrance open.

A company has just been organized under the laws of the State of New York, called "The Ontario Bay Harbor Improvement Association," for the purpose of aiding in the improvement of this harbor. If an appropriation be granted by Congress, the company would join its means to those of the general government for the accomplishment of this very desirable object. The means of the company already amount to about six thousand dollars, ($6,000.)

R 1.

Estimate of the cost of adding 608 *feet in length to the unfinished west pier, and of constructing an east pier* 832 *feet long at Sodus Bay harbor, Cayuga county, New York, and for dredging.*

This will require the construction of 45 cribs, each 32 feet long, 20 feet wide, and 15 feet average height from the soil at bottom to the flooring at top, and 10 feet average height from the soil at bottom to the water level; to be in accordance with the drawings in sheet G, No. 20, and the specifications in table T 2 of our crib work.

1. THE PIERS.

Cost of each crib.

For 1,649 lineal feet of pine timber, hewn 1 foot square, at 14 cents per foot.....	$230 86
For 880 lineal feet of white oak timber, hewn 1 foot square, at 18 cents per foot.....	158 40

For 1,428 feet, board measure, of white oak plank, 3 inches thick, 8 inches wide, and in pieces 20 feet long, for flooring, at $18 per M.....	$26 68
For 2,286 pounds of wrought iron, 1 inch square, for bolts, at 4 cents per pound.....	91 44
For 137 pounds of wrought iron spikes, $\frac{3}{8}$ by $\frac{3}{8}$ of an inch square, at $7\frac{1}{2}$ cents per pound.....	10
For 47 cords of stone for crib ballast, at $3 per cord.....	141
Materials for one crib.....	658 66
For superintendence, workmanship and labor.....	300 00
Sum.....	958 66
Add ten per cent. for contingencies.....	95 87
Estimated cost of one crib..	1,054 53
(1.) Then 45 cribs, at $1,054 53 each, give for the cost of the piers.....	47,453 85

2. FOR DREDGING.

To give 12 feet depth of water in the channel between the inner bay and Lake Ontario, 18,967 cubic yards, at $12\frac{1}{2}$ cents per cubic yard.....	$2,370 88
Tgive 12 feet depth between the proposed piers, 21,365 cubic yards, at 13 cents per cubic yard.....	2,777 45
(2.) Total for dredging.....	5,148 33

Recapitulation.

1. For the piers.....	$47,453 85
2. For dredging.....	5,148 33
Amount required for Sodus bay harbor, Cayuga county, New York.....	52,602 18

J. D. GRAHAM,
Maj. Corps Top. Eng., Bvt. Col. Sup'g Eng.

OFFICE GEN. SUP. OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

R 2.

Colonel Abert to Colonel Graham.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, September 18, 1857.

SIR: I transmit herewith a copy of a letter from John C. Kayser, esq., secretary of the Lake Ontario, Auburn and New York Railroad Company, communicating the decision of that company to advance the necessary funds for prosecuting the work for the improvement of the harbor of Sodus bay, Cayuga county, New York.

I transmit, also, a copy of a decision of the War Department, of June 4, 1853, prescribing the conditions under which the officer of engineers, or other agent of the government, may be instructed to comply with the requests of associations or individuals in like cases.

It being the desire of the honorable the Secretary of War that this matter "be attended to at once," you will immediately enter into correspondence with Mr. Kayser upon the subject, with a view to carrying out the wishes of the company in regard to an early resumption of the work.

Respectfully, sir, your obedient servant,

J. J. ABERT,
Captain Corps Topographical Engineers.

Lieutenant Colonel J. D. GRAHAM,
Corps Topographical Engineers, Chicago, Illinois.

R 3.

From John C. Kayser, secretary of the Lake Ontario, Auburn and New York Railroad Company, to the honorable the Secretary of War.

OFFICE LAKE ONTARIO, AUBURN AND NEW YORK R. R. Co.,
New York, September 14 1857.

The undersigned, in behalf of the Ontario Bay Harbor Improvement Association, had the honor to petition, through the medium of Hon. E. B. Morgan, M. C., the honorable the Secretary of War, on the 28th of last month, to be permitted, under government superintendence, and as set forth in said petition, to resume the work of the improvement of the harbor of Sodus bay, Cayuga county, New York, in order to prevent injury being done, in its unfinished condition, by the storms of the lake, to the work already done, and to progress with the work generally, so as to open this valuable harbor as a place of refuge; and that, to justify the action of your department, they have resolved to advance the money necessary for that purpose.

The season being already far advanced, it becomes necessary that, if any work is to be done this season, the same be commenced forthwith. The undersigned would, therefore, respectfully ask to be informed what

orders, if any, have been given in relation to the matter by your department to enable and authorize the association to commence operations.

With distinguished consideration, I have the honor to subscribe myself, sir, your very obedient servant,

JOHN C. KAYSER,
Secretary.

Hon. J. B. FLOYD,
Secretary of War.

R 4.

Regulations of the War Department.

CIRCULAR.

WAR DEPARTMENT,
Washington, June 4, 1853.

In every case where money is furnished by a State, city, association, or individuals, in order that the same may be expended in the further prosecution of a work of harbor or river improvement to which Congress has given its sanction by a special appropriation, and it shall be requested by the authorities, or persons having charge of such money, that the officer of engineers in charge of such work shall be allowed to continue the operation, in conformity with the plans and designs adopted by the War Department, to the extent the money so provided will permit, the officer of engineers, or other agent of the general government, may be instructed to comply with the request, under the following conditions, viz :

1st. The officer or agent is to have no connexion with, nor responsibility for, thedisbursement of the money so furnished, further than that he may give, from time to time, in compliance with any bargain or contract made under such provision of money, a statement of the amount of work done or material supplied.

2d. It must be perfectly understood by the authorities, or persons supplying money in every such case, that the direction or supervision by the government officer or agent of the operations so carried on is not to constitute, nor to imply, any claim, or shadow of claim, on Congress for reimbursements; nor is it to be considered as pledging the general government to any support of that particular work or improvement beyond that already given by Congress.

JEFFERSON DAVIS,
Secretary of War.

R 5.

Telegraphic despatch from Colonel Graham to John C. Kayser, esq,, secretary of the Lake Ontario, Auburn and New York Railroad Company.

CHICAGO, *September* 28, 1857.

I have received instructions from the War Department in regard to your letter of the 14th instant. I must know the amount of money your company will raise for work this season. Also, if you want dredging at Sodus Bay, Cayuga county. The dredge can go immediately. Answer by telegraph, at once. If necessary, I will go to Sodus.

J. D. GRAHAM,
Lieut. Colonel, &c., No. 67 Huron street, Chicago.

JOHN C. KAYSER,
Office of the Lake Ontario. Auburn and New York Railroad Company, New York city.

R 6.

From John C. Kayser, esq., secretary of the Ontario Bay Harbor Improvement Association, to Colonel Graham.

AUBURN, *October* 8, 1857.

SIR: Your telegraphic despatch was forwarded to me at Fair Haven. In answer, I would state, that the Ontario Bay Harbor Improvement Association organized this month, under the laws of this State, with a capital subscribed of $6,000, three-fourths of which is subscribed in money, and one-fourth in timber and labor—the timber to be subject to the approval of the government superintendent of lake harbors, and at such prices as may be approved and allowed by him.

The association calculated that the amount of $6,000, thus far subscribed, would suffice to put in 300 feet of new pier work, alike in point of material and workmanship to that already constructed by the general government. A contract to that effect is agreed upon between contractors and the association. I beg respectfully to refer to the following articles of the association:

ARTICLE II.

"The object of forming this association is the accumulating a fund, material and labor, for the improvement of the harbor of Sodus, in county of Cayuga, and State of New York, under the direction of the officers of the government of the United States having charge of lake harbor improvements, in a manner that shall be approved of by the officers of the government of the United States having charge of that department and locality.

ARTICLE VIII.

SEC. 3. "Parties subscribing these articles who shall thereby agree to furnish labor or materials are to furnish the same from time to time when required by the superintendent of said association, subject to the law, rules, and regulation of the * * * government superintendent, and at such prices as may be approved and allowed by the government superintendent."

The association would respectfully submit that, in view of the present depressed state in monetary affairs, they would defer the dredging until next season; but have the timber for the pier work collected, put in shape, and the cribs made, so that they could be sunk in spring, as early as the season would permit. Timber is collecting now, subject to your inspection, by the same party who had charge of the government work before, under Colonel Turnbull.

Respectfully waiting your arrangements in this matter, with such instructions as you may deem pertinent to address to me at "New York," *or* "Fair Haven, Cayuga county, New York,"

I subscribe myself, with great consideration, your obedient servant,

JOHN C. KAYSER.

J. D. GRAHAM,
Lieut. Col. Top. Eng., Gen. Supt'g Lake Harbors,
67 *Huron street, Chicago, Illinois.*

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32. OSWEGO HARBOR, NEW YORK.

The works for the protection of this harbor are in a very precarious condition.

They were constructed at a period when, it would seem, there could not have been a just appreciation of the force of the lake sea which they were intended to resist.

During the present season a portion of the work has crumbled which was built only four years ago, at the extremity of the west pier. The crib work has been undermined at four different places, and the stone washed out by the force of the sea. One of these breaches is within one hundred and fifty feet of the light-house. We have endeavored to make temporary repairs at these places, in the best manner practicable, with the very small means at our command; and, indeed, while writing this report our attention has been frequently abstracted from it under the necessity of endeavoring to save important parts of the work from more serious injury. We have not, however, the means to do it in the permanent manner required to make it last.

I consider the light-house to be in danger from the storms which must occur between the present season and the ensuing spring.

The inner harbor, designed to be protected by the works, is also in imminent danger of being seriously injured, if not altogether ruined, unless immediate appropriations be granted for the most urgent repairs required.

For these repairs I herewith submit an estimate, marked S 1, amounting to $46,391 44.

I would earnestly recommend that this sum be granted with as little delay as possible, and in a single appropriation, because it is very important that the requisite materials be collected, and certain portions of the work be done the ensuing winter. The whole work of repairs should be in full vigor on the opening of spring.

The harbor of Osweg , whether considered in a commercial or military point of view, is undoubtedly the most important on Lake Ontario.

By canals and railroads it has a direct commercial connexion not only with Syracuse, Albany, and the city of New York, but also with Philadelphia, to which it is the nearest port on the great lakes. The value of its internal and coastwise trade is not less than sixty millions of dollars per annum, the statistics of which I shall endeavor to present in detail in a future report. It is certainly the most extensive wheat market in the State of New York, and its trade with the Canadas is greater than that of all other ports in the United States joined together.

The Oswego river empties into Lake Ontario at this point. It is a powerful stream, studded with falls and rapids, and the water power derived from it operates a great number of mills and other factories.

It brings into one torrent within its channel the waters of nearly all the small lakes in the western part of the State of New York. The united waters of the Canandaigua, the Seneca, the Cayuga, Owasco, and the Oneida, all flow into it.

Fort Ontario is situated on the east side of this harbor, about twelve hundred feet from the light-house. It overlooks and completely commands the harbor entrance.

It is an important work in the chain of defences requisite, in times of war, for our northern frontier, but its importance would be greatly diminished if the harbor were to become deteriorated for want of the requisite protecting works.

Application was made in March last, by the corporate authorities of the city of Oswego, for the use of the United States dredge boat belonging to Lake Ontario, to be employed, at the expense of the city, in dredging that harbor. A favorable action was taken on the application, and the mayor and common council were informed that the dredge boat and her four scows could be thus employed under the uniform rule of the government in like cases; and the specific conditions contained in the accompanying paper, marked S 7, were offered and accepted by the city authorities.

Finding afterwards, however, that a dredge boat more suitable to their purposes could be procured elsewhere, they declined the use of the United States dredge, and she was employed, as has already been stated, in dredging the harbors of Sodus bay, Wayne county, and Oak Orchard, both in the State of New York.

The accompanying papers, marked from S 2 to S 28, are referred to for explanation on this subject.

S 1.

Estimate of the cost of immediate repairs required for the preservation of Oswego harbor, New York.

The extent of wooden pier work that will require to be repaired, including the late breaches, is equal to 600 lineal feet, 30 feet wide, 4 feet deep below the water surface, and 7 feet high above that surface, making eleven (11) tiers of white oak timber, 1 foot square.

We propose to divide this work into twenty sections, of an average length of 30 feet. Hence, each section will cost as follows, viz:

COST OF EACH SECTION, 30 FEET LONG, 30 FEET WIDE, AND 11 FEET HIGH.

For 2,040 lineal feet of white oak, hewn one foot square, at 20 cents per lineal foot	$408 00
For 2,160 feet, board measure, of white oak plank, 3 inches thick and 8 inches wide, in pieces 30 feet long, for flooring, at $20 per thousand	43 20
For 3,010 pounds of 1½ inch diameter round wrought iron for bolts, at 4 cents per pound	120 40
For 164 pounds of wrought iron spikes for the flooring, at 7½ cents per pound	12 30
For 160 cords of ballast stone, at $3 per cord	480 00
Cost of materials	1,063 90
For superintendence, carpentry and labor	250 00
For tearing away old work and removing the materials, at $3 per lineal foot	90 00
Cost of repairing each section, 30 feet long, of wooden pier work	1,403 90
Then, 20 sections, at $1,403 90, gives for repairing 600 feet lineal of the wooden pier work	28,078 00

2. FOR REPAIRING THE PORTION OF THE WESTERN PIER BUILT IN STONE MASONRY.

For removing 540 cubic yards of dilapidated wall, at $1 50 per cubic yard	$810 00
For building up 780 cubic yards of heavy stone wall, at $10 per cubic yard, including all expenses	7,800 00
Total for stone pier	8,610 00

3. FOR DREDGING.

For the excavation and removal of 30,478 cubic yards of gravel and soil, at 18 cents per cubic yard.....	$5,486 04

Recapitulation.

1. For repairing wooden pier work.....	$28,078 00
2. For repairing stone masonry work.....	8,610 00
3. For dredging.....	5,486 04
Sum.....	42,174 04
Add ten per cent. for contingencies.....	4,217 40
Amount required for Oswego harbor, New York.....	46,391 44

J. D. GRAHAM,
Maj. Corps Top. Eng., Bvt. Lt. Col., Sup'g Eng.

OFFICE GEN. SUP. OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

S 2.

From the Mayor of Oswego to Captain Malcolm.

OSWEGO, *March* 4, 1857.

DEAR SIR: This city have had a public meeting to consider the state of our harbor, and the great danger to our commerce arising from the shallow water on the bar and in the channel by which vessels enter our harbor.

This meeting voted to excavate the channel to a depth of twelve feet; and the common council of our city are taking the requisite steps to accomplish the work during the coming summer; and with a view to this work, I now wish to make, in behalf of the city, application to the United States War Department for the use of the government dredge at this place. I will thank you to lay this application before the appropriate government officers for their action.

We shall desire to commence the work during the month of June next.

Yours, respectfully,

L. B. CROCKER, *Mayor*.

Capt. WM. S. MALCOLM.

S 3.

From Captain Malcolm to Colonel Abert.

OSWEGO, *March* 5, 1857.

SIR: Enclosed you will please receive an application from the mayor of the city of Oswego for the use of the United States dredge the coming summer. They entertain the idea here that your order of last season, turning the dredge over to the city, gives them the use for this year also.

I received, yesterday, a communication from the directors of the Auburn and Little Sodus Railroad Company. They design to prosecute the harbor work and deepen the channel at Little Sodus this spring, and desired to make an application for the dredge, and I referred them to your bureau.

I am, very respectfully, your obedient servant,

WM. S. MALCOLM.

Colonel J. J. ABERT,
Chief of Top. Engineers, Washington.

S 4.

From Colonel Abert to Colonel Graham.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, March 13, 1857.

SIR: I send herewith a copy (S 5) of a letter from this bureau to W. S. Malcolm, esq., of Oswego; also, copies of the letters (S 2 and S 3) to which the one from this office is a reply. You will please attend to this matter and report.

Respectfully, sir, your obedient servant,

J. J. ABERT,
Colonel Corps Top. Engineers.

Lieutenant Colonel J. D. GRAHAM,
Corps Top. Engineers, Chicago, Illinois.

S 5.

From Colonel Abert to Captain Malcolm.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, March 13, 1857.

SIR: I have received your letter of the 5th instant, enclosing one of the 4th from the mayor of Oswego in relation to the use of the United States dredge boat at Oswego.

There is no objection to the use of this boat at Oswego, under the same rules by which its use has been heretofore allowed, but as the superintendence of the works on Lake Ontario is, by order of the War Department, under the immediate direction of Lieutenant Colonel Graham, the letters referred to and a copy of this will be sent him, and you will please await his directions.

Respectfully, sir, your obedient servant,

J. J. ABERT,
Colonel Corps Topographical Engineers.

W. S. MALCOLM, Esq.,
Oswego, New York.

S 6.

From Colonel Graham to Colonel Abert.

No. 172.] OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, April 7, 1857.

SIR: I have the honor to submit to you a copy (marked S 7) of my communication of this date to L. B. Crocker, esq., mayor of Oswego, New York, showing the action taken on your instructions of the 13th ultimo in regard to the use of the United States steam dredge for deepening the channel of Oswego harbor. I beg to be informed if it meets the approval of the Topographical Engineer Bureau and the War Department.

I am, very respectfully, sir, your obedient servant,

J. D. GRAHAM,
Major Topographical Engineers,
Brevet Lieut. Colonel, Superintending Engineer.

Colonel J. J. ABERT,
Chief Topographical Engineer, Washington.

S 7.

Colonel Graham to L. B. Crocker, Esq., Mayor of Oswego, New York.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, April 7, 1857.

SIR: Your letter of the 4th ultimo, addressed to William S. Malcolm, esq., United States custodian, applying, in behalf of the city of Oswego, for the use of the United States dredge boat, now at that place, for the purpose of deepening the channel to your harbor, having been referred to the Topographical Engineer Bureau, and by the bureau referred to this office for action, I have the honor to state to you as follows:

The boat can be used for the purpose above specified on the following conditions:

1. That it is not to be taken from the direction and control of the United States superintending engineer, or that of his specified agent residing at Oswego.

2. That the plan of operations is to be that which was recommended by the United States board of engineers in connexion with the improvement of Oswego harbor, and approved by the War Department.

3. That the corporate authorities of the city of Oswego shall bear the necessary expenses of putting the boat in good working condition, of keeping her in said condition during the operations, and shall deliver her in good order and repair at the end of the working season.

4. That the captain, steam engineer, and watchman of the boat shall be approved by this office, which shall have the power to remove any one of them if found necessary for the security of the vessel, and of filling vacancies, if any, thus created.

5. That all the current expenses of working the dredge shall be borne by the city of Oswego.

6. That the captain, or person in charge, shall report in writing to this office, on the first day of each month, the quantity of work done during the preceding month, and the effect upon the channel and harbor.

The above conditions are the same as those which prevailed in the case of the use of the United States dredge employed in deepening the channel over St. Clair flats in the year 1855.

Please answer as soon as convenient.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Lieut. Colonel, Superintending Engineer.

L. B. CROCKER,
Mayor of Oswego, New York.

S 8.

From Colonel Graham to L. B. Crocker, Esq., Mayor of Oswego.

OFFICE GENERAL SUPERINTENDENCE, &C.,
Chicago, April 23, 1857.

SIR: On the 7th instant I transmitted to the Bureau of Topographical Engineers a copy of my letter to you of the same date, setting forth the conditions on which the United States dredge boat could be used by the corporate authorities of Oswego for dredging your harbor.

I have since received official information that the said conditions have been approved. I must, therefore, request to be informed at as early a day as convenient of the action of your city council on the subject, because, since my action upon your letter of the 4th ultimo on

this subject, applications have been made by other parties to the War Department to be allowed to use the dredge the present season; and I am required to report what disposition is most expedient to be made of it.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Lieut. Col., Sup'g Eng'r, &c.

L. B. CROCKER, Esq.,
Mayor of Oswego, New York.

S 9.

From Leander Babcock, Acting Mayor of Oswego, to Colonel Graham.

CITY CLERK'S OFFICE,
Oswego, April 28, 1857.

SIR: I have the honor to enclose to you a certified copy of a resolution of the common council of this city accepting the care and use of the United States dredge, scows, and appurtenances, upon the terms and conditions prescribed in your letter of the 7th instant, all which I trust will be satisfactory.

I am, respectfully, your obedient servant,

LEANDER BABCOCK,
Acting Mayor.

Lieut. Col. J. D. GRAHAM,
Sup'g Eng'r, &c., &c., Chicago.

S 10.

Resolution of the Common Council of the City of Oswego, passed April 21, 1857.

Resolved, That the use and care of the United States dredge boat, scows, and appurtenances, be accepted for and in behalf of the city of Oswego on the conditions and stipulations contained in the letter to the mayor from Lieutenant Colonel J. D. Graham, under date April 7, 1857, and that the mayor notify Colonel Graham thereof, and furnish him with a certified copy of this resolution.

CITY CLERK'S OFFICE, *Oswego.*

I, the undersigned, clerk of the city of Oswego, do hereby certify that I have compared the foregoing with the original resolution entered upon the journal of the common council of said city, and that the same is a correct transcript therefrom and of the whole of said resolution.

Witness my hand, and the seal of said city, this 28th day of April, 1857.

WM. L. MASON, *Clerk.* [L. S.]

S 11.

Col. Graham to Wm. S. Malcolm, Esq.

OFFICE GENERAL SUPERINTENDENCE,
Chicago, May 6, 1857.

SIR: Your letter of the 22d ultimo is received. I herewith enclose to you a draft on the assistant treasurer at New York for two hundred and seven dollars, being the amount of your estimate for repairing the harbor piers at Oswego. ($207.)

The stones to be put into the cribs should be the heaviest that can be procured; otherwise they are easily forced from their positions by heavy seas. The timber to be added in the repairs should be fastened by iron bolts at least one inch square and twenty to thirty inches long, according to circumstances.

Please keep me constantly informed of the condition of the piers, and of any repairs that may be necessary.

In your letter of the 22d ultimo you say "the common council do not intend at present to use the United States dredge; and I do not think they will operate it this season, as they propose now to work the *Osgood*, or spoon dredge, which they consider better adapted for excavating our channel, which is composed of large stone and rock formation."

"The city will probably make use of our scows, as the Osgood dredge is without any."

I regret that I did not know all this in the first instance, because, under the circumstances above quoted, I could not consistently have awarded the use of the United States dredge to Oswego, when other harbors on Lake Ontario are equally entitled to her services, and were urgently applying for them. The conditions communicated to the mayor of Oswego in my letter of the 7th ultimo were based upon the understanding on my part that the city council would at once proceed to have the dredge and her scows put in complete working order under your direction, and set them all to work in dredging the harbor in accordance with the plan of improvement which has been approved by the War Department. If the dredge is allowed to lay up without the usual repairs after a working season, she and her machinery will deteriorate materially. Moreover, it is a principle from which we cannot depart, that the United States scows cannot be separated from the United States dredge, to which they are essential appurtenances. The dredge cannot be laid up at Oswego, because other harbors are equally in want of her services; and wherever she goes her scows must accompany her. You will please explain this to the mayor and council, and assure them that, with every disposition on the part of this office to forward the improvement of their harbor, I am compelled to withdraw the dredge and her scows under the circumstances reported by you.

In the meanwhile you will lose no time in having the United States scows thoroughly recaulked in case they require it; also the machinery of the dredge cleaned up, and all necessary repairs attended to, and

you will forward an estimate of funds for the same, to be charged against such harbor as the dredge and scows shall go to work for when the repairs shall be completed.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Lieut. Col., Sup'g Eng., &c.

WM. S. MALCOLM, Esq.,
United States Custodian, Oswego, New York.

S 12.

Colonel Graham to the Acting Mayor of Oswego.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, May 6, 1857.

SIR: Your letter of the 25th ultimo, with the resolution of the common council of your city, passed on the 21st ultimo, accepting the use and care of the United States dredge boat, scows, and appurtenances, for and in behalf of the city of Oswego, on the conditions and stipulations contained in my letter to the mayor of the 7th ultimo, has been received. From a letter which I have since received from the United States custodian at Oswego, I fear there is some misunderstanding on your part of the third item of those conditions under which it was intended that the dredge should be immediately put in good working condition at your expense, and then immediately put to work to dredge the harbor.

Mr. Malcolm informs me that your city authorities will probably not use the United States dredge, but propose to use her scows to tend an Osgood or spoon dredge in dredging your harbor. I beg leave respectfully to state, for the information of the common council, that the United States scows cannot, under any circumstances, be separated from the United States dredge boat, to which they are appurtenances. Moreover, that there are several other harbors on Lake Ontario that were applicants for the use of the dredge and her scows at the same time that your city authorities applied, that have equal claims upon these government machines, and that will be glad to have the use of them on the same conditions as were communicated in my letter to the mayor of Oswego of the 7th ultimo.

I have, therefore, been obliged to instruct Mr. Malcolm, the United States custodian of the dredge and her scows, to proceed at once to put them in complete working condition, the expense to be charged against such harbor as these vessels shall go together to work for when the repairs shall be completed. This I am obliged to do to meet my responsibility to the War Department. I beg to refer you to my letter of this date to Mr. Malcolm on the subject.

I remain, very respectfully, your obedient servant,

J. D. GRAHAM,
Lieutenant Colonel, Superintending Engineer.

LEANDER BABCOCK, *Acting Mayor,*
Or to the Mayor (if present) of Oswego, New York.

S 13.

From Captain Malcolm to Colonel Graham.

OSWEGO, *May* 8, 1857.

SIR: Will you please inform me whether you consider the United States dredge (at this place) as having been turned over to the city of Oswego by your letter addressed to the mayor of the 7th of April last.

I am, very respectfully, sir, your obedient servant,

WM. S. MALCOLM,
Captain of Steam Dredge Boat.

Colonel J. D. GRAHAM,
Gen. Sup. Engineer of Lake Harbor Works, Chicago.

S 14.

From Captain Malcolm to Colonel Graham.

OSWEGO, *May* 9, 1857.

SIR: I have the honor to acknowledge the receipt of your letter of the 6th instant, instructing me to repair the United States pier at this place, and also your check for $207 to defray the expense. I have noted the contents in relation to the *manner* of the repairs.

As the mayor of the city is absent, and the common council meet on Tuesday next, I will then notify them of the withdrawal of the dredge, and assign the reason. Mr. Babcock, the chairman, informed me, yesterday, that they did not consider the dredge as having yet been turned over to the city, as they had not received your order to that effect. The river is unusually high, and the dredge could not be operated here for at least twenty days to come.

No delay shall take place in carrying out your order in relation to the caulking of the scows, repairing and cleaning of the machinery of the dredge.

I will furnish you an estimate of the expense next week. In ten days she can be made ready for any service she may be assigned to.

I am, very respectfully, sir, your obedient servant,

WILLIAM S. MALCOLM,
United States Custodian and Captain of Steam Dredge Boat.

Colonel J. D. GRAHAM,
Gen. Sup. Engineer of Lake Harbor Works, Chicago.

S 15.

From Captain Malcolm to Colonel Graham.

OSWEGO, *May* 11, 1857.

SIR: Enclosed you will please receive an estimate of the funds required to repair and fit out the United States dredge and scows at this place, and also a copy of the letter addressed to the mayor by me, withdrawing the same from the use of the city.

I am, very respectfully, sir, your obedient servant,

WILLIAM SCHUYLER MALCOLM,
United States Custodian and Captain of Steam Dredge Boat.

Colonel J. D. GRAHAM,
Gen. Sup. Engineer of Lake Harbor Works, Chicago.

S 16.

OSWEGO, *May* 11, 1857.

GENTLEMEN: I have been instructed by Lieutenant Colonel J. D. Graham to assure the city authorities that, while there is every disposition on the part of the government to forward the improvement of your harbor, he cannot permit the United States dredge to remain unemployed.

Other harbors on Lake Ontario, equally entitled to her services, are urgently applying for her. The high water of the Oswego river will prevent her being used for at least a month to come; in consequence of which, the order granting her use to the city is hereby most respectfully withdrawn.

I am, gentlemen, very respectfully your obedient servant,

WILLIAM S. MALCOLM,
Captain of Steam Dredge Boat.

The MAYOR AND COMMON COUNCIL *of the city of Oswego.*

S 17.

OSWEGO, *May* 11, 1857.

Estimate of funds required for caulking, painting, and repairing the United States dredge and four scows, at Oswego, New York.

170 yards cotton drilling for upper deck, at 12½ cents per yard	$21 25
20 papers of tacks	1 00
Caulking dredge and 2 boats	80 00
2 mechanics for 14 days, at $1 75 each per day	49 00
Castings, iron and steel, and oil and packing	10 00

200 pounds of paint, at 9 cents per pound	$18 00
16 gallons of linseed oil, at $1 06¼ cents per gallon	17 00
10 days' labor for painting and glazing, at $1 50 each	15 00
2 brushes, turpentine and glass	3 25
500 pounds of Manilla rope, at 15 cents per pound	75 00
25 days' extra labor, at $1 each day	25 00
Towing dredge to government pier	6 00
Docking, caulking, and repairing 4 scows	200 00
For contingencies	25 00
Amount	545 50

WILLIAM S. MALCOLM,
United States Custodian and Captain of Steam Dredge Boat.

S 18.

Colonel Graham to William S. Malcolm, Esq.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, May 14, 1857.

SIR: Your letter of the 8th instant is just received, and for an answer thereto I beg leave to refer you to the instructions contained in my letter to you of the 6th instant. The United States dredge, you will thereby perceive, is not to be turned over to the city of Oswego, unless the city will proceed at once to set her to work in conjunction with her scows in dredging Oswego harbor on the completion of the repairs of the dredge and her scows, which you were instructed in my letter of the 6th instant to lose no time in making. When these repairs shall have been completed by you, please report the same to this office; then you will be informed where the dredge and her scows will go to work.

When these repairs shall have been completed, the vessels, without being separated, can be used, under the direction of this office, for dredging Oswego harbor in accordance with the approved plan of the War Department, provided the city authorities choose to pay the cost of the said repairs and the current expenses of the dredging. This will be in compliance with the report in the case which has been approved by the War Department, and which I am held responsible for carrying out.

I hope the dredge and her scows will be completely repaired as soon as practicable, as they ought to be at work for the benefit of some one of the Lake Ontario harbors as soon as possible.

I hope you understand that these vessels are at no time to be separated from your official custody as long as they remain at Oswego.

I am, very respectfully, your obedient servant,

J. D. GRAHAM,
Lieut. Colonel, Superintending Engineer, &c.

WM. S. MALCOLM, Esq.,
United States Custodian, Oswego, New York.

S 19.

Colonel Graham to William S. Malcolm, Esq.

OFFICE GENERAL SUPERINTENDENCE, &c.,
Chicago, May 18, 1857.

SIR: Your letter of the 11th instant is received, with the accompanying estimate of expenses of repairing the United States steam dredge and her four scows, amounting to the sum of $545 50.

I herewith enclose to your order my draft on the United States assistant treasurer at New York for the said sum, namely, $545 50, to be applied to that object. Please sign and return to me the enclosed duplicate receipts for said sum, which it is hoped will be sufficient to put the dredge and her scows in complete order. Please give a vigorous personal supervision to insure the work being pushed forward with industry and efficiency. It is important that the deck of the dredge should be made perfectly tight, in order to prevent injury to the machinery in wet weather. The engine and machinery should be thoroughly overhauled and cleaned, or they will deteriorate. Please let me know what engineer of machinery will do that part of the work, and if he is a very skilful mechanic in his line of business.

I am, very respectfully, sir, your obedient servant,

J. D. GRAHAM,
Lieut. Colonel, Superintending Engineer.

WM. S. MALCOLM, Esq.,
United States Custodian, Oswego, New York.

P. S.—I should think cotton drilling hardly stout enough for covering the upper deck of the dredge. I would prefer your using canvas; or if you could purchase sail-cloth that has been about half worn, but sound, and paint it well, it would perhaps be about as cheap as the cotton drilling, and would last much longer. If you cannot find such, get some light new canvas. J. D. G.

S 20.

From Captain Malcolm to Colonel Graham.

OSWEGO, *May* 20, 1857.

SIR: Enclosed you will please receive the note from the acting mayor, declining the use of the United States steam dredge.—(See S. 21.)

Yesterday the city voted the tax to raise $10,000 for the purpose of dredging this harbor.

I have been obliged to re-cover the upper deck of the dredge with cotton cloth, and have it painted with fire-proof paint, and have taken out the old friction rollers and journal, and have replaced them with new ones. They were entirely worn out.

The scows are all repaired. I have put in them six new cog-wheels.

One of the scows had its end pressed in by the ice last winter, and the repairs upon them have been considerable. If I can have two days' fair weather this week I shall send all the vouchers for the repairs of the pier and dredge on the 25th instant.

I have engaged the same engineer that we have had for the last three years, and at the same compensation, viz: $60 per month; the mate, or foreman, at $30 per month. The department have allowed me $4 per day while engaged in active employment on the pier, and $100 per month, and board, when in command of the dredge, which I trust will meet your approbation.

Every preparation has been made to leave immediately on the receipt of your order. The weather for the last ten days has been most inclement.

I remain, sir, very respectfully, your obedient servant,

WILLIAM S. MALCOLM
Captain of Steam Dredge Boat.

Col. J. D. GRAHAM,
General Superintending Engineer of Lake Harbor Works.

S. 21.

From the Chairman of the Common Council of the city of Oswego to Colonel Graham.

OSWEGO, *May* 18, 1857.

SIR: I have to say that the city of Oswego is not now in a position to use the United States dredge and appurtenances, and will not be for two or three months to come, and may not want her during the present season. We therefore cannot object to her use by other applicants, hoping that we can have the use of her in the season of low water next August.

I am, respectfully, your obedient servant,

LEANDER BABCOCK,
Chairman Common Council.

Lieut. Col. J. D. GRAHAM.

S 22.

From Captain Malcolm to Colonel Graham.

OSWEGO, *May* 23, 1857.

SIR: I have the honor to acknowledge the receipt of yours of the 18th instant. The dredge and scows have been repaired; engine overhauled and repaired; the dredge gearing put in order according to your instructions, and now await your further orders.

I have put cotton drilling on the upper deck; it is of the same quality as was originally used; it has been on a week. I thought of

the sail-cloth for covering, but supposed it might take too much paint; the boiler has been pumped up, and every arrangement made to start immediately after the crew and stores are on board.

The funds sent me for the pier and dredge will be ample in defraying all the expenses for their repair; the pier had seven holes in it. Our engineer is every way satisfactory, skilful, industrious, and temperate. The dredge had not been painted in two years, and the rigging on hand was worthless.

I have given my entire time to the supervision of their repairs, and if it had not rained so much, should have been ready several days since.

I am, very respectfully, sir, your obedient servant,

WILLIAM S. MALCOLM,
Captain of Steam Dredge Boat.

Colonel J. D. GRAHAM,
Gen. Sup. Eng. of Lake Harbor Works, Chicago.

S 23.

From Captain Malcolm to Colonel Graham.

OSWEGO, *May* 29, 1857.

SIR: Enclosed you will please receive the vouchers for the repairs of the pier at this place. There remains in my hand $87, balance of the $207 you sent me on the 6th of May instant, for the above repair. There is also a balance due you in my hands, $19 64, from your check of $545 50 sent the 18th instant; making the whole amount in my hands due you $106 64.

I put into the pier 7 cords of stone, repaired 7 breaches where the stone had washed out, and 500 pounds of spike. The pier is in excellent condition. The dredge is entirely fitted out, and is in every respect in good order. I have employed a ship keeper. All of which I trust will meet your approbation.

Very respectfully, your obedient servant,

WILLIAM S. MALCOLM,
Captain of Steam Dredge Boat.

Colonel J. D. GRAHAM,
Gen. Sup. Eng. of Lake Harbor Works, Chicago.

S 24.

Colonel Graham to Colonel Abert.

OFFICE GENERAL SUPERINTENDENCE OF LAKE HARBOR WORKS,
Chicago, June 17, 1857.

No. 175.]

SIR: After the acceptance by the city authorities of Oswego, New York, of the use of the United States steam dredge for Lake Ontario, for the purpose of dredging that harbor, in accordance with the con-

ditions communicated to the bureau in my letter, No. 172, of April 7 last, (see S 7, *ante*,) which were afterwards approved by the bureau and the War Department, I received a letter from Leander Babcock, esq., chairman of the common council, (the mayor being then absent,) declining the use of the dredge. A copy of Mr. Babcock's letter on the subject is hereto attached, (marked S 21, *ante*.)

In the meantime the dredge and her scows had been put in order for active work. They had, therefore, to be used somewhere, and I directed Captain William S. Malcolm, who has the immediate custody of them, to proceed to dredge the harbors of Sodus bay, Wayne county, New York, and Oak Orchard creek, New York; the people of these harbors being the next applicants for her use. The expenses of putting the dredge and scows in working order to be charged to the appropriations for the said harbors, and the actual expenses of working them to be charged to the appropriation for the harbor where the work is actually done.

I hope, sir, that this arrangement will meet the approbation of the bureau and the department.

I herewith respectfully return to the bureau the letter of Nelson Clark, esq., of March 28, and that of Erastus Rogers, esq., of April 8, and its accompanying memorial addressed to the honorable the Secretary of War on this subject.

I am, sir, very respectfully, your obedient servant,

J. D GRAHAM,
Major Topographical Engineers,
Brevet Lieutenant Colonel, Superintending Engineer, &c.

Colonel J. J. ABERT,
Chief Topographical Engineer, Washington.

S 25.

From Captain Malcolm to Colonel Graham.

OSWEGO, *June*, 19 1857.

SIR: I have the honor to acknowledge the receipt of your order of the 16th instant, directing me to repair, with the United States dredge and her scows, to the harbor of Sodus bay, Wayne county, and to operate there for the improvement of the channel.

I have also noted the contents of your letter, and will write you more fully to-morrow.

Enclosed you will please receive the vouchers for your check of 16th instant for $400.

I am, very respectfully, sir, your obedient servant,

WILLIAM S. MALCOLM,
Captain of Steam Dredge Boat.

Col. J. D. GRAHAM,
Gen. Sup. Eng. of Lake Harbor Works, Chicago.

S 26.

Colonel Abert to Colonel Graham.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, June 22, 1857.

SIR: Your letter, No. 175, of the 17th instant, has been received and submitted to the War Department, with a report, of which the enclosed is a copy.

Respectfully, sir, your obedient servant,

J. J. ABERT,
Colonel Corps Topographical Engineers.

Lieut. Col. J. D. GRAHAM,
Corps Top. Eng'rs, Chicago, Illinois.

S 27.

Colonel Abert to the Secretary of War.

BUREAU OF TOPOGRAPHICAL ENGINEERS.
Washington, June 22, 1857.

SIR: In reference to the letter from N. Clark, esq., dated March 28, 1857, I have the honor to submit a copy of a report from Lieutenant Colonel Graham of the 17th instant.

It is respectfully recommended that the course pursued by Lieutenant Colonel Graham be approved, and that he be directed not to exceed in his expenditures unexpended balances.

Respectfully, sir, your obedient servant,

J. J. ABERT,
Colonel Corps Topographical Engineers.

Hon. JOHN B. FLOYD,
Secretary of War.

[Endorsement on the above.]

Approved.

JOHN B. FLOYD,
Secretary of War.

WAR DEPARTMENT, *June* 23, 1857.

S 28.

From Captain Malcolm to Colonel Graham.

OSWEGO, *June* 22, 1857.

SIR: I expect to leave here this evening with the United States dredge, in compliance with your order of the 16th instant, to dredge the harbor of Sodus bay, Wayne county, and shall endeavor to reach there without the use of a tug.

I have appointed Mr. Charles R. Paddock custodian during my absence, at a compensation of fifteen dollars per month.

My post office address there is Sodus Point, Wayne county.

I remain, sir, very respectfully, your obedient servant,

WILLIAM S. MALCOLM,
Captain of Steam Dredge Boat.

Colonel J. D. GRAHAM,
Gen. Sup. Engineer of Lake Harbor Works, Chicago.

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33. OGDENSBURG HARBOR, NEW YORK.

This harbor is at the mouth of the Oswegatchee river, on the river St. Lawrence. It is about sixty miles below the outlet of Lake Ontario, but as it is connected therewith by an extensive navigation, we range it under Lake Ontario head.

The town and port of entry of Ogdensburg is situated here. It is the western terminus of the Northern railroad, which extends to Rouse's Point, on Lake Champlain, and has a connexion thence with New York and Boston. Being opposite to Prescott, in Canada West, and about 130 miles from Montreal, it has always been an important point in our military operations upon this frontier.

A great quantity of flour, grain, and merchandise is, since the construction of the railroad, transhipped here both for the interior and coastwise. Every requisite facility for this business has already been provided by the Northern Railroad Company. What is now wanting is proper protection for vessels lying here. A survey, preparatory to the necessary plans, was made last season under the direction of Colonel Turnbull, but I have not been furnished by the Topographical Bureau with a copy of the map derived from this survey.

In the absence of digested plans for this improvement, I would recommend an appropriation for its commencement, to be expended in conformity with a plan to be first approved by the War Department, of twenty thousand dollars, ($20,000.)

AN ADDITIONAL STEAM DREDGE FOR LAKE ONTARIO.

For the reasons given in the case of an additional steam dredge, with appropriate mud scows, for Lake Erie, I recommend that the same be granted for the Lake Ontario harbor works.

One such machine is entirely insufficient to perform the dredging annually required for the harbors on this lake, and there is now only one.

The estimate marked N 1, under the head of "an additional steam dredge boat for Lake Erie," will equally serve for the same on Lake Ontario. I therefore offer it as follows, viz:

1. For a new steam dredge boat, with machinery and appurtenances	$15,938 00
2. For six mud scows for same	2,458 00
3. For two additional mud scows for the present steam dredge on Lake Ontario	836 00
Total required for a new steam dredge and 8 mud scows for Lake Ontario	19,232 00

V.—LAKE CHAMPLAIN HARBOR WORKS.

34. BURLINGTON BREAKWATER, VERMONT.

This work, although not yet completed to the full length designed to be given to it, has proved a most valuable protection in times of storms to steamboats and other vessels navigating Lake Champlain. It is now one thousand and sixty-nine (1,069) feet long, and is thirty-five (35) feet wide at the top surface. It is composed of wooden crib work filled with stone, and is in 30 feet water.

The last crib put down was 100 feet long, and was added in the year 1853. It was not entirely finished for the want of a sufficient appropriation, and has suffered considerably in consequence.

I agree with Colonel Turnbull in recommending that it be extended so as to bring the north extremity under cover of the point of land to the north, and thus afford a more complete shelter from the north-westerly winds. This will require an addition of two hundred (200) feet in length.

For this purpose, and repairs now much needed, I herewith present an estimate marked T, amounting to $21,285 31.

I would recommend that this sum be granted in one appropriation, in order that the work may go on to completion without further delay. It would afford important protection to our armed ships in time of war, and is therefore a valuable auxiliary in our system of military defence of the northern frontier. Under this consideration alone I would respectfully recommend it to the care of the government.

The important fortification at Rouse's Point, called Fort Montgomery, is fifty miles from this place; and on the south side of the entrance to Burlington harbor there is a light-house standing on Juniper island.

There are now four steam dredge boats on the lakes within the district assigned to my charge, namely:

One on Lake Michigan.
One on Lake Erie.
One on Lake Ontario.
One on Lake Champlain.

It is very important that they should be constantly kept in good working condition. To do this requires that there should be a special fund provided for that object. I would earnestly recommend, therefore, that for this purpose the sum of $2,500 be appropriated for each of these machines and its appurtenances, including the scows; or,

For the four machines and their appurtenances..... $10,000

T.

Estimate of funds required to complete the unfinished work on the breakwater at Burlington, Vermont, for necessary repairs on the old work, and to extend the breakwater 200 feet to the north.

1. For repairs, and to complete the unfinished work of 1853:

Services of one foreman 60 days, at $2 50 per day.....	$150 00
Services of 5 carpenters for 60 days, at $1 50 per day each.....	450 00
Services of 5 laborers for 60 days, at $1 per day each....	300 00
For 5,500 cubic feet of pine timber, at 14 cents per cubic foot.....	970 00
For 3,840 feet, board measure, of white oak plank, 3 inches thick, at $20 per M.....	69 60
For 6,170 lbs. of wrought iron, for bolts, at 4 cents per pound.....	246 80
To complete unfinished work and for repairs.....	2,186 40

2. For extending the breakwater 200 feet:

For 40,804 lineal feet of hemlock timber, at 9 cents per lineal foot.....	3,672 36
For 14,980 lineal feet of pine, at 10 cents.....	1,498 00
For 8,880 cubic feet of pine, squaring 18 inches by 18 inches, at 16 cents.....	1,420 80
For 4,800 feet, board measure, of white oak plank, 3 inches thick and 8 inches wide, at $20 per thousand..	96 00
For 50,400 pounds of 1½ inch round wrought iron for bolts, at 4 cents per pound.....	2,016 00
For 630 pounds of wrought iron spikes, 9 inches long and ½ by ½ of an inch square, at 8 cents per pound...	50 40
For 880 cords of ballast stone, at $3 per cord.....	2,640 00
For augers, tools, &c.....	150 00
For pay of an agent or assistant to superintending engineer, 1 year.....	1,460 00

For 1 foreman 120 days, at $2 50.....	$300 00
For 12 carpenters 120 days, at $1 50 each per day.....	2,160 00
For 15 laborers 120 days, at $1 each per day.	1,800 00
Sum.....	17,363 56
Add 10 per cent. for contingencies.....	1,736 35
2. For extending the breakwater 200 feet northward...	19,099 91

Recapitulation.

1. For completing unfinished work and for repairs.....	$2,186 40
2. For extending the breakwater 200 feet northward....	19,099 91
Amount required for Burlington breakwater, Vermont.	21,286 31

J. D. GRAHAM,
Maj. Corps of Top. Eng., Bvt. Lt. Col., Sup'g Eng.
OFFICE GEN. SUP. OF LAKE HARBOR WORKS,
Chicago, September 30, 1857.

CONCLUSION OF THE REPORT ON LAKE HARBOR IMPROVEMENTS.

In concluding this my annual report for 1857, I would respectfully recommend that the repairs of the several harbor works on our northern and northwestern lakes be attended to without delay. Whilst engaged in drawing up this report, my attention has been frequently called off from it to give the necessary directions, under the most pressing emergencies, in order to endeavor to check the work of dilapidation threatened by the violent lake storms usual at this season of the year.

This has unavoidably delayed the report; but I considered that a paramount duty rested upon me to give my attention, under the emergencies stated, to the safety of the works whenever I had the means at command.

All of which is respectfully submitted.

J. D. GRAHAM,
Maj. Corps of Top. Eng., Bvt. Lt. Col., Sup'g Eng.
Col. J. J. ABERT,
Chief Topographical Engineer, Washington.

RECAPITULATION OF THE ESTIMATES.

Amount of the estimated cost of the completion of the several lake harbor improvements on the northern and northwestern lakes, under the superintendence of Brevet Lieutenant Colonel James D. Graham, Major of Topographical Engineers, together with the sums asked the first year towards that object.

Name and nature of work.	Am't required to complete the work.	Sum asked for the first year.
I. Lake Michigan harbor works.		
1. *Chicago harbor, Ill.*—Extension and repair of the piers, and dredging	$174,450 74	$87,225 37
2. *Waukegan harbor, Ill.*—Construction of 1,380 feet of breakwater	137,966 10	60,000 00
3. *Kenosha harbor, Wis.*—Extension of piers, chevaux-de-frise, sand barrier, dredging basins to give capacity for a harbor of refuge, and removing the bar and deepening the channel between the piers	58,047 24	58,047 24
4. *Racine harbor, Wis.*—Extension of the harbor piers and making a survey of the harbor	17,422 73	17,422 73
5. *Milwaukie harbor, Wis.*—Repairs of piers at the natural mouth of the river, and dredging	40,341 26	40,341 26
6. *Sheboygan harbor, Wis.*—Extension of piers, repairs, and dredging	36,614 55	36,614 55
7. *Manitowoc harbor, Wis.*—Extension of piers and dredging	62,780 94	40,000 00
8. *Michigan City breakwater, Ind.*—For 2,000 feet of breakwater to form a roadstead for the general commerce of the lakes, and for armed vessels	384,376 50	100,000 00
9. *New Buffalo harbor, Mich.*—For the construction of 1,200 feet of pier work, piling, excavation, and dredging channels and basins, to adapt it as a harbor of refuge to the wants of the local commerce of the place	98,113 47	60,000 00
Additional, to render it suitable for a harbor of refuge for the general commerce of the lakes, and for armed ships	69,494 32	
10. *St. Joseph's harbor, Mich.*—Construction of piers, tearing away old work, repairs, and dredging	97,633 91	50,000 00
11. *Black Lake harbor, Mich.*—Pier construction, close piling, pile-wharfing, excavation, and dredging	128,343 02	42,781 00
12. *Grand River harbor, Mich.*—Pier construction, close piling, and dredging	160,185 60	53,395 20
13. *South Black river, Mich.*—Pier construction and dredging	39,180 61	39,180 61
14. *Kalamazoo river, Mich.*—Pier construction, close piling, and dredging	64,099 63	32,049 81
II. Lake St. Clair harror work.		
15. *Mouth of Clinton river, Mich.*—Close piling and dredging	31,407 17	15,703 58
III. Lake Erie harbor works.		
16. *Monroe harbor, Mich.*—Pier extension, repairs, and dredging	23,857 90	23,857 90
17. *Sandusky harbor, Ohio.*—Pier and breakwater crib work	112,117 00	56,058 50
18. *Huron harbor, Ohio.*—Pier construction, rebuilding and repairing, and dredging	41,183 32	30,000 00
19. *Vermillion harbor, Ohio.*—Erecting and repairing piers	42,856 61	21,428 30

RECAPITULATION—Continued.

Name and nature of work.	Am't required to complete the work.	Sum asked for the first year.
20. *Black River harbor, Ohio.*—Rebuilding and repairing piers	$33,881 93	$16,940 96
21. *Cleveland harbor, Ohio.*—Tearing away old work, rebuilding and repairing piers	44,757 87	44,757 87
22. *Grand River harbor, Fairport, Ohio.*—Pier extension and repairs, and dredging	41,498 94	41,498 94
23. *Ashtabula harbor, Ohio.*—Pier construction and repairs, and dredging	38,013 56	19,006 78
24. *Conneaut harbor, Ohio.*—Pier erection, repairs, and dredging	31,559 60	15,779 80
25. *Erie harbor, Penn.*—Completing the harbor according to the plan of the board of engineers	417,499 95	113,012 99
For immediate dredging and repairs of breaches	8,638 00	
26. *Dunkirk harbor, N. Y.*—To complete the harbor on the plan of the board of engineers, *i. e.*:		
For eastern, middle, and western breakwaters	401,818 66	85,663 69
For immediate repairs of breaches	5,299 96	
27. *Buffalo harbor, N. Y.*—For repairs of piers, rebuilding wall, and dredging	27,679 35	27,679 35
IV. Lake Ontario harbor works.		
28. *Oak Orchard harbor, N. Y.*—For extending the harbor piers, repairs of the present piers, and dredging	61,498 55	26,990 62
29. *Genesee River harbor, N. Y.*—For tearing away old work above low water level, and rebuilding the same	41,084 34	41,084 34
30. *Sodus Bay harbor, Wayne county, N. Y.*—For tearing away old pier work above low water level, rebuilding the same, and dredging	40,806 00	40,806 00
31. *Sodus Bay harbor, Cayuga county, N. Y.*—For pier extension and dredging	52,602 18	26,301 09
32. *Oswego harbor, N. Y.*—For repairs of wood and stone pier works, and dredging	46,391 44	46,391 44
33. *Ogdensburg harbor, N. Y.*—For improvement of	20,000 00	20,000 00
V. Lake Champlain harbor works.		
34. *Burlington harbor, Vt.*—Breakwater extension, and completing unfinished work and repairs of old work	21,285 31	21,285 31
(*a.*) For surveys of harbors and inlets on the coast of Lake Michigan, to ascertain what other harbors on said lake require improvement	10,000 00	10,000 00
(*b.*) For an additional steam dredge boat and eight scows for Lake Erie	19,232 00	19,232 00
(*c.*) For repair of the present steam dredge boat and her four scows on Lake Erie	1,950 00	1,950 00
(*d.*) For an additional steam dredge boat and eight scows for Lake Ontario	19,232 00	19,232 00
(*e*) For repairs of the four steam dredge boats now on Lakes Michigan, Erie, Ontario, and Champlain, $2,500 each	10,000 00	10,000 00
Total	3,215,202 25	1,511,719 23

J. D. GRAHAM,
Major Top. Engineers, Brevet Lt. Col., Superintending Engineer.

Office General Superintendence of Lake Harbor Works,
Chicago, December 31, 1857.

Col. J. J. Abert,
Chief Topographical Engineer, Washington.

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MDZ Münchener DigitalisierungsZentrum Digitale Bibliothek

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Bd.: [112,n.] 1857 = Doc. Nr. 42 = Congress 35, Sess. 1

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Am.b. 3040-112,n
urn:nbn:de:bvb:12-bsb11037109-2